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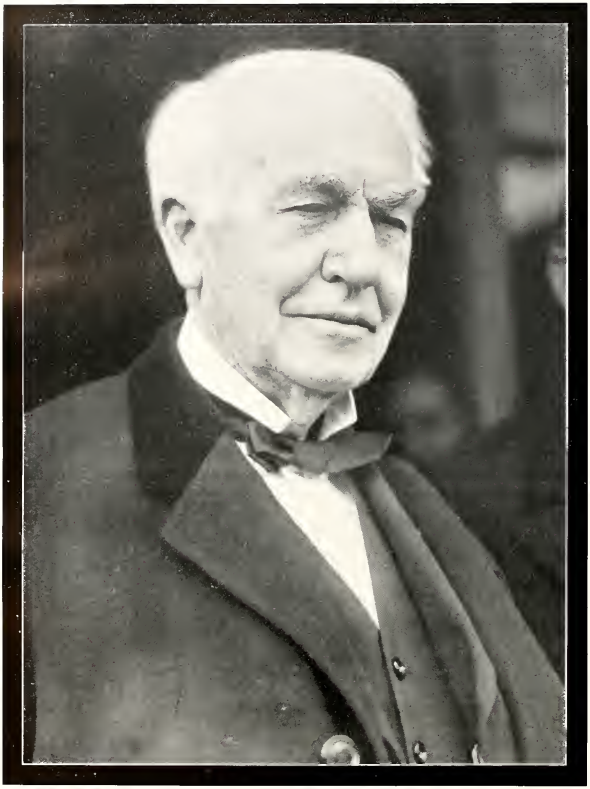


Thomas Alva Edison

1847 -- 1931

The Armour Engineer

Volume XXIII November, 1931 Number 1

Illumination Features of The Century of Progress Exposition

By C. W. Farrier, '16

Assistant Director Of Works Century Of Progress

SPECTACULAR uses of illumination are expected to make Chicago's 1933 World's Fair an exposition that will be talked of throughout the world. At the same time, new utilizations of lights and novel methods of obtaining dramatic effects may be developed which will profoundly influence the future of the science of illumination.

With the towering skyline of Chicago as a backdrop, the site of A Century of Progress Exposition offers a splendid opportunity for picturesque illumination. The Fair grounds at night can be made into a scintillating panorama of lights—an ever-shifting scene with delicate pastels, brilliant hues and an ebb and flow of rainbow colors.

These effects can be made visible for miles out on Lake Michigan and up and down the shore line. They will satisfy the urge of visitors for new and unusual things to see. Startling displays in lighting will be produced not merely for the sake of showmanship, but with an aesthetic and practical intent and an eye on the future.

The foremost brains in the science of illumination are being mobilized to make this Exposition a great lighting spectacle. The resources of great electrical companies, their most recent discoveries and highly perfected equipment are being made available to A Century of Progress for this purpose. A committee composed of some of the most notable illumination experts in America has been formed to work out plans. In the Administration building on the lake front, a lighting laboratory is in operation where various devices are tested, new schemes of lighting are evolved, and the problems arising from the location, building design, and coloring are studied.

The long trail from the carbon arc lamp and incandescent bulb to the Neon tube has wrought some startling improvements in illumination. Most of this development has occurred in the forty years which have elapsed since the World's Fair of 1893. In this period the metallic filament incandescent light has been developed with a higher intensity of light, an amazingly longer life and added efficiency. Concentrated filaments have been perfected which permit the focusing of a beam of light for specific illumination purposes. The discovery and improvement of gaseous tubes and vapor tubes of various descriptions has widened the illumination horizon wonderfully. At the same time the development of light projecting apparatus has registered corresponding advancements.

Expositions of

Main facade of the administration building as viewed from the portico of the Field Museum

the past have contributed much to the development of illumination. In 1893 when the incandescent lamp was still young, the exterior illumination effects at the World's Fair were obtained by stringing or festooning exposed bulbs of sixteen and thirty-two candle power around the exteriors of the buildings. This system became subsequently known as "Outline" lighting.

The eleven years that elapsed until the St. Louis Fair in 1904 witnessed practically no change, except that this type of illumination was expanded in volume.

In 1915 the San Francisco Exposition introduced "floodlighting" for what is thought the first time, in which the sources of the light were concealed. The surfaces of some of the buildings were bathed in clear light and sometimes in lovely pastel shades from these concealed lights. Glass jewels illuminated like blazing gems were also used for the first time in this exposition to adorn the towers and buildings. The illumination of the 1915 Panama-Pacific Exposition provided an unforgettable experience for those who saw it.

Within the past few years outstanding effects in illumination have been achieved at the Rio de Janeiro Exposition in South America and at the Barcelona Fair in Spain. In the Barcelona Fair in particular, new advancements in lighting were apparent. Colored lights swept over almost the entire exposition grounds in rhythmic cycles by means of a central control station.

The experience and developments of the past will be utilized as a foundation for the illumination schemes of the 1933 Chicago World's Fair. But the lighting engineers are striking out in new directions, making use of new materials and evolving a new philosophy of illumination.

Naturally, many of the things that were applicable to an exposition in the past will not be practical in the case of A Century of Progress. For instance, in the 1893 Fair and in most of those which have succeeded it, the buildings were practically all colored white. In the 1933 Fair the buildings will be colored in a variety of hues, including reds and blues, whites, blacks and yellows, gold and silver. This in itself will necessitate the use of devices to accentuate and differentiate the various colors of the structures. In previous Fairs, use has been made of symmetry and balance in the grouping of buildings about a central lagoon or concourse. The 1933 Exposition utilizes balance in composition but not in symmetry. The buildings will present masses rather than height. These architectural departures require a similar departure in illumination practice.

As they are now projected, the general plans for the exterior illumination of the 1933 Fair contemplate an increase in the intensity and spectacular qualities of the lighting as it rises vertically. That is, the building surfaces close to the ground may be bathed in misty light, while the towers and pylons and high points will blaze with brilliant illumination effects such as metallic jewels of high reflected candle power, visible for miles around Chicago and out on Lake Michigan. It is planned that the recessed portions of the buildings will be made intense pools of light, against which the projecting portions will stand out in bold silhouette.

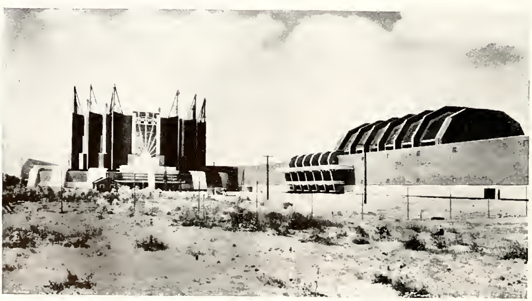
An interior view of the main hall of the Administration building.

At strategic points between the lower and upper illumination levels, there may be special lighting effects to catch the eyes of the millions of visitors. These may include dancing and scintillating colors, shadow effects, luminescent and iridescent features, vapor effects, water-falls, flaming pylons, and other breathtaking effects.

The general effect may be compared to the spectacle of a city shrouded with mist in the early morning, but with the tops of its spires, towers and tall buildings piercing the mist and shining forth in the sun.

A number of especially pic-

(*Continued on page 26*)



Above is shown the Travel and Transport building which embodies the first application to architecture of the suspension bridge principle.

The Hoover Dam

By G. W. Schodde, '32

Student In the Department of Fire Protection Engineering

FOR untold centuries the waters of the Colorado have been allowed to tear their way through its deep canyons and spread periodically over the valleys of the southwest. The challenge of this river of destiny has been heard and once again man has set out to subdue, control and utilize the waters rightfully named the Red River in 1740 by Father Francisco Ganees.

The Colorado has been sawing its way through these rock mountains for ages, its turbid waters descending more than 7,500 feet to reach sea level. During these long years there have been periods when the river, swollen by the melted snows and spring rains, became a roaring monster discharging at its feet as high as 300,000 cubic feet per second. Then this river of extremes has settled to a quiet, peaceful stream carrying only 2,000 cubic feet per second to the southland thereby placing the 450,000 acres now under irrigation and the 60,000 people under the threat of being washed out or burnt up.

Man has accepted this last challenge of Nature and on December 21, 1928, the President approved the Boulder Canyon Project Act, which authorized the construction by the Secretary of the Interior of the Boulder (now Hoover) Dam and incidental works on the Colorado River at a cost not to exceed $165,000,000.

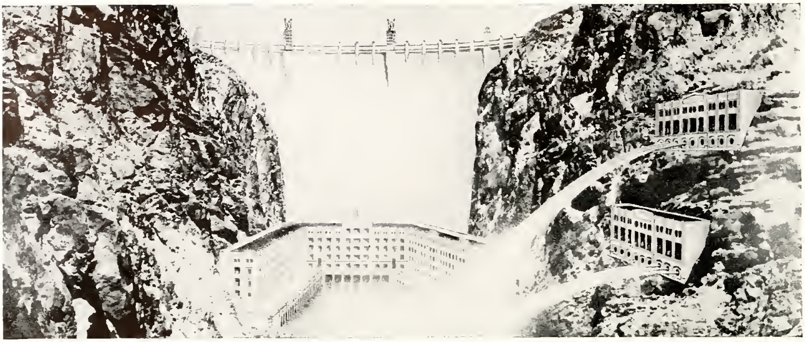
This mammouth undertaking will be closely watched by the engineering world for problems will come up that have never been faced before. The dam will repay the government for its expenditure by controlling the floods, improving navigating conditions and regulating the flow of this famous Red River; by storing water and delivering it for irrigation purposes in this large corner of the United States; by governing the silt deposits and furnishing a water supply for the metropolitan southwest; and lastly furnishing 1,000,000 or 1,200,000 horse power of hydro-electric energy, depending upon the requirements of the contractors who purchase the power.

Above scene shows the channel which has been cut through the mountains by the Colorado River.

When the dam is in place an annual 100,000 acre-feet of mud will be dropped into the lake but this lake is so large that two centuries will pass before this mud deposit will be noticed.

Before the actual work can even be started plans had to be formulated for transportation, living quarters and power. For this work is going on in a country where the temperature ranges from 20 to 120 degrees F. Where sand, sagebrush and lizards are your company and only rough, unmarked, often washed out, trails cross from one desert wharf to another. The sun beats so insistently and the air is so dry that one quickly loses his love for the rugged beauty and splendor of these mountains and deep gorges.

The need for transportation facilities was met by the government and the states of Nevada and Arizona. A 22.7 mile branch railroad from the Union Pacific main line to Boulder City is now completed. The United States section of this branch railroad, 10¼ miles in length, running from Boulder City to the canyons rim, is now under construction. The contractor has put in 20 miles of railroad himself. The vertical ele-



Courtesy "New Reclamation Era"

An artists conception of the completed dam, showing dam, powerhouse, and massive rock through which it is necessary to cut and blast.

vator running from the canyon rim to the rivers bed is in itself an engineering feat, for the handling of the materials for the dam alone will be a tremendous task. More than 5,000,000 barrels of cement will be required, enough to tax the capacity of two ordinary cement plants. About 19,000,000 pounds of reinforcing steel will be used and large quantities of lumber will be needed. Several million pounds of explosives are required for foundation, diversion and spillway excavation. The great turbines and generators for the power house will have to be lowered and installed. The 3,700,000 cubic yards of excavated material will have to be brought to the rim and unloaded on the desert's floor. This inclined freight elevator guide structure will be located on the slope of the canyon wall immediately downstream from the power house on the river. It will complete a rise of 594 feet. A channel is to be excavated in the rock wall and lined with concrete in which track rails, structural guides, and other metal work will be installed to guide the elevator car. A spur track constructed in a concrete foundation will connect this guide structure to the power house. The speed of this transfer car is 60 feet per minute and the size of the car platform is 12 feet by 50 feet, large enough to hold any freight car. This transfer car will be used by the contractor during the construction period for transporting labor, materials and supplies. Even after the construction of the dam, power plant, and appurtenant works, the elevator will still be used by the government for general operation and maintenance purposes.

Trucking conditions have been accentuated by the building of an air-line oiled highway to Las Vegas and then to Boulder City. This road we found to be exceptionally good but in continual danger of being washed out, especially during the month of August. The government has constructed an oiled road from Boulder City to the rim of the canyon overcoming heavy grades and cutting through rock cliffs. It is expected that another highway will soon be built on the east side of the river to connect the dam with Kingman, Arizona. A roadbed has been begun about 100 feet above the water and its ribbon like winding has been extended by the aid of blasting and machinery for several miles. How they get up or down seems a miracle for blank walls and a gaping chasm envelope them, although in seemingly constant danger of toppling off, they push their blunt noses further and further along the steep sides.

Like in the rush days of "'49," Boulder City has risen from the desert carpet of sagebrush and forced its way towards the sky but unlike those earlier boom towns Boulder City will be a well-planned town. Contracts are being let for buildings, waterworks, sewerage system, lighting system, street surfacing, sidewalks and curbs. A total cost of $2,000,000 will be required to build the town. A steel tank holding 2,000,000 gallons of water receives its supply from a pumping station being built by the Nevada-side engineers. Pumps are being installed which will lift the water 2,000 feet through the 9 miles of pipe lines.

The power is being furnished by the Southern Sierras Power Co. who brought the Hoover Dam line a distance of 222.2 miles from San Bernadino, although the work was started at Victorville. The transmission conductor is 4/0 aluminum strand cable, steel reinforced. The standard supports are two legged, H type, latticed steel structures, spaced 7 to the mile with 34-foot steel angle cross arms. The line is insulated with 9 insulator disks on suspension and 10 on dead ends. The total weight of steel is 5,000,000 pounds; there are 1,080,000 pounds of cable and 48,840 insulator disks.

The tedious job of stringing this cable was greatly aided by the use of tractors which carried the cable and by proper manipulation laid the cable in a never-ending stream at a rate of 1.45 miles per day; a performance which is believed to be close to a record for this type of construction.

The cost of the completed transmission and telephone lines and sub-station will approximate $1,500,000 but in no sense is this wasted for after the power plants at the dam are in operation this high line will be carrying power away.

With these basically vital problems met and accomplished before ever actual work on the dam begins the engineers have their foundations well laid.

The first task is the diversion of the river itself and this is being

accomplished by the excavation of four great diversion tunnels 50 feet in diameter and extending almost a mile in length. They will be bored, two through each mountain. This task alone presents one of the major undertakings of the whole enterprise.

Four tunnels have eight ends which provide eight points at which men and machinery can be applied to the task. That they might apply more machinery and more man power the contractor ran an 'adit' which is a cross tunnel intersecting the line of the major tunnels, from each side of the floor of Black Canyon. These adits cut the mile-long tunnels in two parts and created new points from which work on them might be prosecuted. They in fact doubled the number of points of attack. They provided sixteen such points instead of eight.

These tunnels are being bored in spite of the worst climate conditions, for the temperature along the river bed runs as high as 129 degrees F. with no ventilation to relieve the atmosphere. By blasting and the use of Ingersol-Rand air compressors they have already "holed through" on the pioneer bore of the first of the great tunnels which are to carry the flow of the Colorado river while Hoover Dam is being built. The progress of one day is reported as being 163 linear feet by crews working at 11 different heads. On account of the size of the work it can practically be called quarrying rather than tunneling. The procedure being followed is first to run a twelve-foot tunnel all the way through on what is to be the floor of the big tunnel. This makes it possible then to install a car system of loading and carrying away the other 38 feet that must be removed in creating the 50-foot tunnel.

A stationary air producing plant has been constructed to supply the air compressors that are making the tunneling possible. It consists of a battery of class PRE, direct connected, electrically driven compressors having a combined capacity of 25,000 cubic feet per minute.

These tunnels are to be finished in 18 months. An average five-story house might be moved through them without scraping on top or sides. 1,563,000 cubic yards of rock will have to be removed from the tunnel, raised to the rim, and deposited on the desert. The whole undertaking will necessitate the removal of about 5,800,000 cubic yards. 8,000 miles of drill holes will be required in getting out this rock while hundreds of tons of drill steel will be worn out in penetrating this breccia rock formation.

These tunnels will be lined with a minimum of 2 feet of concrete, thus making a total excavation of 56 feet in diameter and extending for a distance of 4,000 feet. These tunnels that are costing over $5,000,000 each are to be used after the dam is built to carry the excess water from the dam into the mighty turbines of the power house at its base. They thus serve both in a temporary and permanent capacity. The two nearest the river will carry water to the power wheels, and the two outer ones will carry away flood waters if at any time there should be an overflow. The Rowe Tunnel in France is the only one that equals or betters these four tunnels and that has a width of 78 feet 6 inches and a height of 54 feet 4 inches.

The Guernsey Dam with its gates 50 by 50 feet are of similar character to those going in these tunnels and they have been operating successfully for several years. Greater size, greater weight, and greater strength will be needed to open and close these 50 foot diameter apertures so they will be 63 feet wide, 58 feet high, 21 feet thick and weigh 13,200 pounds.

A new problem has confronted the engineer in the waste-way. As can be seen by the diagram this is an inclined shaft starting from the highest water level of the reservoir and connecting with the two outside tunnels. The architects have provided the outlet works with a capacity of 400,000 second feet while the great flood of 1884 was only 250,000 second feet. A second-foot of water is one cubic foot passing a given point in one second of time.

The water in dropping down this 650 foot inclined shaft will give rise to a velocity of 175 feet a second. This is higher than present day experience justifies as all known precedents stop at 100 feet. So as to be sure of what the outcome will be the engineers have been making tests for months. Concrete blocks have had jets of water with velocities of 175 feet per second pointed direct-

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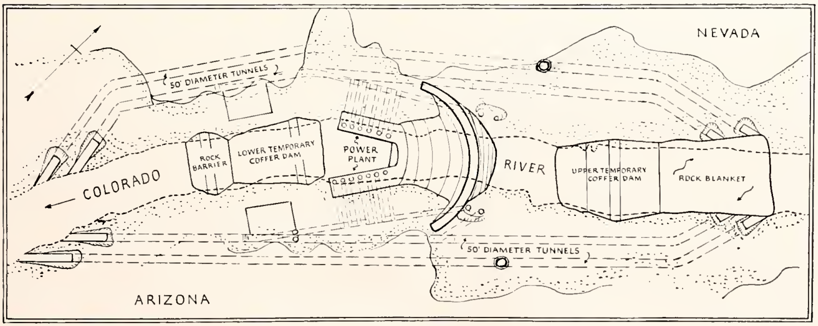

Courtesy "Explosives Engineer"

Diagram showing the general layout of the Hoover Dam construction work as now being carried out.

Sunspots and Radio

By James W. Juvinall, '33

Student in the Department of Electrical Engineering

It has been quite apparent to those whose interests have been focused on radio since its popular inception some ten years ago, that of late years, long distance reception has decreased most appreciably. This observation is the more discrepant when there is considered the advent and general utilization of vastly improved facilities both for the broadcast and reception of radio signals.

The radio engineer, at loss to find some terrestrial explanation for this seeming incongruity, turns his attention to more far reaching sources, and his search is rewarded by the discovery of a practically positive relation between sun spot activity and radio reception. To even the layman, this revelation may be removed from the category of the impossible to the field of the highly probable, merely by his observation of the fact that daytime reception in the broadcast zone is vastly poorer than night-time reception. This constitutes the most obvious exhibition of the effect of the sun's rays upon radio. And so it is not out of place here to present a brief treatise on the hypothetical explanation of solar activity as coincides most nearly with the views of the majority of scientists.

To the observer on our planet, sunspots appear through the telescope or large binoculars, as dark, circular spots on the photosphere. They begin in a small black point, which grows into the dark "umbra" or center, and then the lighter "penumbra" or outer ring fills out. After perhaps a month, the penumbra closes inward over the umbra and destroys the spot. On rare occasions sunspots have been visible to the naked eye. Sunspots have been described as "great solar storms resembling tornadoes, in which the hot vapors, whirling at high velocity, are cooled by expansion." Hale, of the Mount Wilson Observatory in 1908, by means of the spectroheliograph, was able to photograph different layers of the solar atmosphere and so to definitely establish the existence of vortices which are characteristic of cyclonic storms in the earth's atmosphere. By analyzing, with polarizing apparatus, the character of the rays of light radiating from the sunspots, he was able to demonstrate that the light emitted from the center of these gigantic whirls showed unmistakably that they were electro-magnetic poles.

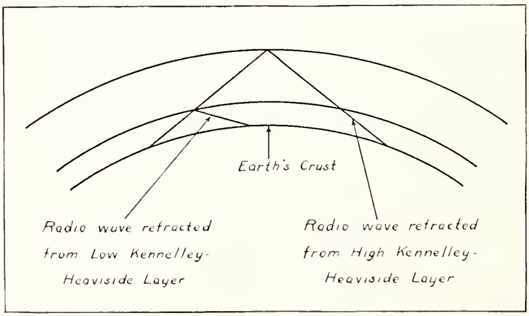

Diagram showing the difference in radio waves retracting from high and low Kennelley-Heaviside Layer.

It was definitely established, with the reappearance of the last sunspot cycle, that the polarity of these spots completely reverses from one cycle to the next. The phenomena led Bjerknes, a Norwegian scientist, to suggest that sunspots are only the visible ends of tubular vortices which may extend for great distances below the sun's surface. A reversal in the direction of whirl would account for a reversal of the magnetic polarity of the sunspots with the change of cycle.

The ultimate origin of these whirls has never been explained with complete satisfaction. However, a highly plausible theory has been propounded as a result of the observation of a certain peculiarity in the sun's behavior. It has been discovered by spectroscopic observations that the period of rotation of the sun is not the same for different parts of the solar surface; at the equator, the period is twenty-four and one-half days, whereas, in the latitude of sixty degrees, the rotation period is nearly thirty-one days. It is probable, therefore, that this continued slipping of the atmospheric layers of lower latitude past those of higher latitude might result in eddy currents which would be favorable to the formation of cyclonic whirls, thus resulting in the phenomenon known as sunspots.

A most extraordinary feature of sunspots is their periodicity. For a century and a half, sufficient records have been kept of the appearance of sunspots to enable the "degree of spottedness of the solar system" to be plotted against time. The standard unit now in universal use is the Wolfner number, which equals

$$K(10g + f)$$

where "g" is the number of groups and single spots, "f" is the total number of spots, and "K" a constant, depending on the telescope, the observer and conditions, and being unity for a three-inch telescope magnifying

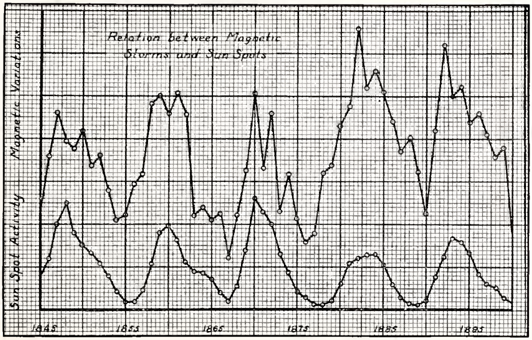

Diagram demonstrating the relation between Magnetic Storms and Sun Spots.

sixty-four times. The resulting curve shows an eleven and four-tenths year cycle, superimposed upon which are twenty-five month and fifteen month fluctuations.

This curve is almost in exact coincidence with the curve of the intensity of terrestrial magnetic storms. During a severe storm, the compass needle may swing several degrees within an hour, and the earth's field strength may vary as much as four or five hundredths of a gauss. In the light of such a remarkable relation between sunspot activity and magnetic storms on the earth, it is highly probable that the magnetic vortical whirl of sunspots acts as a directing field in guiding electrons escaping from the sun.

The induced currents caused by the earth's interception of a stream of electrons, will distort the terrestrial magnetic field, and cause the variations in the compass needle and other manifestations of magnetic disturbances characterizing a magnetic storm.

If such a hypothesis be accepted, auroral displays may be easily explained. When a conspicuous spot appears near the center of the solar disc approximately in line with the centers of the earth and the sun, there is a very good chance that an electron, in its flight between the two, may strike one or more molecules in the rarefied upper atmosphere. If the velocity of the electron at the instant of collision is sufficiently great, it may knock one of the electrons out of the molecule, and instead of one electron and uncharged molecule, there are two electrons and a positive ion. This is known as ionization by collusion. The light accompanying the auroral display is accounted for by the fact that every time an ion, which has been formed by collusion, recombines with an electron, it gives out a spurt of light of a definite wave length. The effect is exactly the same as that when cathode rays in a vacuum tube ionize the minute quantities of gas in the tube and cause it to glow.

Therefore, if the electron theory be admitted as a working hypothesis, it can be stated almost without reservation, that sunspots, whether they themselves be cause or effect, are responsible for an excess number of electrons being transmitted to the earth from the sun.

In consequence of these electromagnetic effects of sunspot activity on the earth, it is plausible that radios, being closely allied with such phenomena, be also affected by such activity. Rough comparisons were made in 1925 and a curve of the estimated relative intensity of radio reception in all parts of the earth co-incided with some degree of accuracy with the Wolfner curve.

It was not until February of 1926, however, that actual quantitative measurements of radio reception were begun and an accurate record kept. G. W. Pickard in his laboratory in Newton Center, Massachusetts, devised a set of apparatus for determining in an impersonal and unprejudiced manner, the intensity of the incoming radio signals. The radio apparatus is a super hetrodyne receiver feeding into a self recording galvanometer which registers the strength of the carrier wave of the broadcasting station.

Radio station WBBM in Chicago was selected to cooperate with Dr. Pickard in the research. This broadcasting station scrupulously maintains a constant energy output in its antenna circuit, and the receiving set is callibrated each day by means of a small local oscillator in the laboratory. The output of the local oscillator necessary to maintain full deflection of the recorder in the receiving circuit is then read from the microammeter in the circuit, and so the constant of the apparatus is determined. Thus local sources of error at both the transmitter and the receiver are eliminated, and any variation in the reception may be attributed whol-

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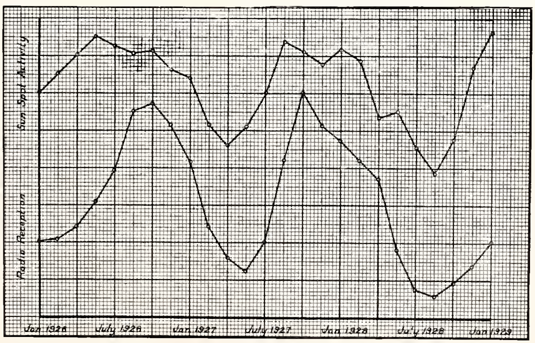

Above is a sketch showing the variation in Radio Reception and Sun Spot activity over a period of 1 year.

The Eleventh Annual E. C. M. A. Convention

By A. R. Viel, '32

Student in the Department of Chemical Engineering

EVERY year, representatives of the members of the Engineering College Magazines Associated meet in convention. Editors or business managers from the twenty-four publications, issued by the largest engineering colleges in the country, gather to further their common aims; to realize more fully the ambition of performing a duty in the most perfect manner possible. There is much to be said, and even more to be done in the few days set aside for this meeting. One is subjected to fleeting impressions and lasting ideas by the score.

The Eleventh Annual Convention was held on the 16th, 17th, and 18th of last month on the campus of Penn State College. The time and place were most delightfully in harmony and the trip to the East was one that will be remembered for many years.

Splashes of violet, gold, crimson, and orange adorn the symmetrical hills of Pennsylvania-land at this season of the year. Ever changing yet ever pleasing is the sensation greeting the eye. All this was set in a background of restful deep green verging into canary. Winter slipping into the highlands and tinting the leaves of the abundant flora and trees by a natural chemical process had created a delight to the eye. It was easy to appreciate but impossible to depict. Speeding over the Pennsylvania highways, these unique combinations which nature had contrived at each turn of the road—at each crest of a hill, were enjoyed to the fullest.

Practical as engineering men get in their devotion to their measurements, they cannot cultivate the habit of seeking-out beauty everywhere in the world. But here was splendor which would not be ignored—which held the attention by an attraction so strong that it could not be denied—showing a force in nature not measurable in dynes, yet having enormous influence. Into this land of central Pennsylvania the delegates to the ECMA convention migrated from all sections of the country. Each one was impressed by this lavish display of nature's rampant colors. Into this land they were received by the Penn State College people who apparently had not left undone a single thing which they might do for the comfort, convenience and pleasure of their guests. Every moment not taken up by the duties of the convention was devoted to pleasurable pastimes. My companion and I repeatedly expressed the regret that every student at Armour was not there to enjoy this combination of conditions so splendid. It was immediately plain from the first gathering that every delegate had come on business and serious business at that. At the round table discussions, some of the most vital topics were discussed. All the details of editorial policy, the methods of ironing out difficulties attendant upon composition, the problems of subject matter, style, and arrangement were all aired and argued over. Everyone was intensely interested, for the vexation of an editor in California today may tomorrow become the stumbling block of one in New York. To be prepared for them is to be doubly qualified. Here was an example of eager enthusiasm for a common cause if ever there was one. The intense atmosphere of this first day's work was dispelled in the evening by a smoker. In a more personal way, these delegates from all parts of the country met and discussed generalities which were valuable to all.

E. C. M. A., the abbreviation commonly used to designate the Engineering College Magazines Association, is an organization of twenty-four established engineering college publications and is dedicated to the advancement of the standards of engineering college journalism. The organization since its founding has standardized undergraduate engineering publications.

Each year a convention is held with one of the member publications acting as host and herewith is presented a view of the 1931 convention held at Penn State College.

The second day was devoted to discussions of topics of business interest just as the first was to matters of editorial concern. Here were aired the problems of advertising, circulation, and business management in general. Costs and expenses, rates and charges, these and a hundred more items became the interest of some twenty-four business managers of college publications. Some spirited debates and lengthy arguments added fire to the meeting but the fierce battles were merely evidences of a desire to do things more efficiently.

After the hectic activities of the morning and afternoon, the delegates took part in affairs of a far different character that evening. A banquet deserving of the most praiseworthy adjectives was held in the evening. Better than good food, entertaining talkers, and all that goes with a successful banquet were here. To top this most lively session, a dance was held following the banquet. The belles of Penn State were out in force; beauty, personality, and winningness all combined.

Saturday was taken up with finishing the business of the convention. In the afternoon a remarkably vivid sight-seeing trip was taken over the historically beautiful locality. Picturesque landscape, inspiring panoramic scenery, and places of genuine historic interest made the trip a long-to-be remembered experience.

The Well Rounded Engineer

By

Dr. Allen D. Albert

Assistant to the President

A Century of Progress Exposition

Dr. Allen D. Albert

THE man who gave of his means and his leadership to create this institution is not fully represented by any of the monuments which bear the name of Armour. He achieved the building of a great business, a quiet leadership in citizen ideals, a continuation of those ideals in the persons of his manly sons, and most of all the glory of a good name. Yet I am wondering as I consider the graduating class of Armour Institute of Technology if any memorial could possibly give him such joy as that which is represented in his influence through the students of this institution? No one of them in past years, no one of you, but is a monument to Mr. Armour's faith in his fellows. Wheresoever you go, whatsoever you find to do, you are a reflection of his belief that education is a liberator of men and an enrichment of life and that in useful service you shall be justified.

In an era when the profession has a larger acceptance and a larger meaning than ever before the graduates of Armour Institute of Technology put on the title of engineers. Ours is an engineering age. Indeed it is so much an engineering age that the several professions of engineering are cumbered with the seaweed entanglements of a thousand imitations.

The article herewith presented was given by Dr. Albert as the commencement address to the graduating class of Armour Institute of Technology on June 11th, 1931, at the thirty-fifth annual commencement exercises. Because of the far reaching scope and because of the valuable information embodied in the address, it is presented here to the undergraduates who were unfortunate in not being able to hear Dr. Albert's message.

We have mechanical engineers, electrical engineers, sanitary engineers, structural engineers, railway engineers, engineers of building materials—these and many others reveal the subdivision which is the seal of a widening usefulness and justifies the dignity with which modern society invests the title. We have also engineers, putative and pretending, of other sorts—engineers of sales management, engineers of money raising, engineers of advertising, engineers of psychology, and even engineers of beauty parlor organization.

Modern society, measured according to our present human experience, is coextensive with engineering. We have been wont to think of our society as the product of Greek civilization and the Italian renaissance. More practically it is the product of capitalism as developed in the 11th and 12th centuries; of organization which produced the factory system before the advent of steam in the 17th century; of the work of a brilliant young instrument maker trained as you have been train-

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Engineering News

Steam Turbine Driven Airplane

Within a few months test flights will be made on a plane driven by a steam turbine with a reduction gear between the turbine and the propellor. If it works, a process of refinement will be undertaken aimed at making it the standard engine for standard aircraft. At present no development in the small sizes will be undertaken.

The boiler in this new plane will be of the multiple water-tube, quick-steaming type, operating at 1,000 lb. pressure and fired by ordinary fuel oil. Condensors will be placed in the wings and, it is expected, will have sufficient capacity to reduce the water supply to 25 gals. in the 2,350-hp. plant. The turbine will be of the impulse type, expanding in three stages. Its high speed will be brought down to propellor speed through special spur gearing.

Use of fuel oil rather than gasoline will bring about some economy of operation. But the greatest economy is expected in the item of maintenance. The cost of valve grinding, carbon cleaning, piston and ring replacement, and such other major items as are unavoidable with a gasoline engine, will be eliminated. While a turbine will not run forever, it is expected that the plant will require only minor adjustments for at least three years of normal operation.

The vital matter of weight per horse power is still a problem. Some lightness, it is believed, will have to be sacrificed in order to use devices of successful performance records. However, the first plant constructed will be little if any heavier than gasoline engines of equal power and it is expected that before very long they will be able to produce the new turbine engine of even a lighter weight.

Moisture Determination in Lumber

The determination of moisture content in lumber is no longer the lengthy, complicated and time-consuming operation it once was. An electrical apparatus has been developed which is based on the measurement of the resistance between two fixed points driven into the specimen to be tested. The apparatus utilizes two neon glow lamps, one of which is connected across a fixed condenser so adjusted that the tube flashes about once a second on the discharge. The other neon tube, connected across an adjustable condenser has inserted in series with the circuit, the knife-edge electrodes on the testing hammer. The rate at which the condenser charges and discharges will depend upon the conductivity of the wood and hence upon the moisture present. This second circuit is tuned so that the two tubes flash simultaneously and the dial reading of the variable condenser may be interpreted as the percentage of moisture in the lumber being tested.

Courtesy—Electrical Engineering

Above is shown the Portable Electric Lumber Moisture Tester as it is used.

Mechanical Cyclonic Separator for Pulverized Coal

Increased pulverizing capacity, uniform fineness of product regardless of wear on pulverizing elements, and reduction in horsepower per ton of finished material are now possible, through the use of a new air separator or classifier, in connection with a coal pulverizer of the air separating type. The new classifier is installed between the mill and burner and is operated as a self-contained unit.

With this classifier in the circuit the mill is fed to capacity regardless of fineness, with just enough air through the mill to transport the material, fine and coarse, into the bottom of the classifier. Secondary air, either hot or cold, is admitted to the separator at the same point. The extreme coarse particles drop out of the air current in the lower portion of the separator and are returned to the mill. The primary air from the mill and the secondary currents carry the medium and fine particles of coal upward. At this point the air and material are brought into contact with a series of revolving paddles which throw the material outward and downward. The fine particles are carried through the fan at the top of the separator to the burner at the boiler furnace. The principal of the classifying action is atomizing the material centrifugally with an air current traveling cyclonically towards the center of the fan intake.

The classification can be varied as desired with identical volumes of air passing through the separator. This is of particular importance since it permits the delivery from the mill of a rich or lean mixture of fuel and air, and a reducing or oxidizing flame can be produced at will.

Transfer Switch for Two-Speed Fan Motors

Two-speed squirrel-cage induction motors are frequently used for boiler fans and they require some form of transfer switch. This switch is a simple double-throw device for a two-speed motor or a two-motor combination, but becomes more complicated when more than two-speed combinations are used. A recent development is a selector switch of three pole double throw design, with three positions: low speed, high speed, and off, and following in that sequence, that is, there is no off point below low and high when accelerating. When changing from high speed to low speed the transition is under control of a speed governor, which prevents low-speed connection until the motor has slowed down.

This switch is cam-actuated, mounted on anti-friction bearings, and driven by a ¼-hp. direct-current motor. No attempt is made to stop the cam accurately at a given point, it being allowed to come to rest against dynamic braking of the motor. Dynamic braking is secured on the compound driving motor without additional contactor parts by connecting the braking resistor permanently across the armature. No overload device is provided, as the switch is not intended to interrupt high values of current in normal operation. It is designed as a transfer switch to be installed with a circuit breaker for handling overload or short circuits.

Manual operation is provided for from a detachable handle. Rotation of this handle through slightly more than one revolution will move the switch from any position to an adjacent position. Transferring from automatic to manual operation is done by disengaging a small lock pin and pulling out on the manual drive shaft.

Similar switches have been made in the air-break form for 440-volt service, carrying additional contacts for reconnected motors, and for the secondary or rotor circuits, where required.

Tallest Arc-Welded Building

The tallest building erected to date using the electric arc welding process is shown in the accompanying photograph. It is 246 feet high with a base about 100 feet square.

The method used in the construction is interesting. All the

Courtesy—Electrical Engineering

The tallest arc-weded building rising nineteen stories above the ground.

connecting angles and shelf angles were welded to the larger columns on the ground. On the actual job, the horizontal members were then rested upon the angles and welded to the vertical columns. It is significant that almost twice as much welding was done in the shop than was necessary overhead. The advantages of such a condition are obvious. It was found that the building was erected with practically complete absence of noise and at a greatly reduced steel tonnage over that attendant upon rivet construction.

Production of Liquid Fuel From Water Gas

There now appear to be three main sources of production of liquid fuel other than crude oil, namely, coal carbonization, hydrogenation of coal under pressure, and production of liquid fuels from water gas. The two former ones are greatly handicapped by the prevailing low prices of oil; as to water gas, the situation is more complicated. Successful synthesis, on a manufacturing scale, of methyl alcohol from carbon monoxide and hydrogen under pressure has been accomplished, and is a very simple process. As a liquid fuel, however, methyl alcohol is not very suitable, because of its low calorific value. Various investigations have been carried out on the synthesis of higher alcohols from water gas and an oily product has been obtained which consisted mainly of oxygenated substances such as alcohols, aldehydes, ketones, acids, and esters.

At first it was thought that the products of the reaction consisted mainly of saturated hydrocarbons, but it was later found that considerable amounts of olefines were formed, and cases were found where the proportion of unsaturated hydocarbons was greater than that of the saturated. The effect of conducting the synthesis at a higher temperature was to increase the proportion of heavy hydrocarbons in the liquid.

The products separated into aqueous and oily layers, and almost the whole of the oily layer after removal of acids was suitable as a fuel. It appears that the character of the products depends on the temperature and, particularly, pressure at which the process is carried out.

Automatic Street-Lighting Control

The latest addition to the ever-growing list of photo-electric applications is that of controlling street lighting circuits. Such a control unit has recently been installed on the roof of an Albany, New York building.

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THE ARMOUR ENGINEER

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ARMOUR INSTITUTE OF TECHNOLOGY

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Make The Armour Engineer the best technical college publication in the country.

I have but one lamp by which my feet are guided, and that is the lamp of experience. I know no way of judging the future but by the past.

—Patrick Henry

THE STUDENT ENGINEER in his daily travels through the routine courses of his chosen engineering field seldom, if ever, stops to reflect upon the intrinsic value of the great variety of subjects with which he is brought into contact. The wide scope of material that he is required to study usually has no other significance to him than the application of an excessive amount of useless labor in uninteresting subjects. Yet, if he will stop to deliberate upon this fact—that every new class, professor, and subject literally opens up to him a golden gate of opportunity through which he may pass and uncover latent talents and abilities—he will perceive a motive for intensive study that heretofore has never been apparent to him.

By far the larger percentage of the students are not sure of themselves in-so-far as their specific professional likings are concerned. This is evidenced by the fact that so many engineers branch out into other technical and non-technical fields after graduation.

Therefore, the engineering student who is apparently showered with an avalanche of economics, business law, history and English in addition to his regular work of physics, chemistry, and mathematics, for example, should not become discouraged but should accept, philosophically, each new "adventure into opportunity" with the attitude that here, possibly, is the subject that might turn out to be of such tremendous interest and value to him that he will make it his life profession.

THE ARMOUR ENGINEER wishes to take this opportunity of expressing its welcome to the Freshmen and all new men enrolled in Armour Institute of Technology. This word of welcome may seem a bit late to the men who are aware of the fact that they are now in the full swing of the school year, however, this being our first official opportunity of meeting the Freshmen on the printed page, we do not feel any material sense of laxity in extending such a welcome.

To the class of 1935 we wish the best of success and four years of school life which will not only be pleasant but also fruitful both to the individual students and also to the Institute because of the presence of the students who

make up this new class. While not professing to be experts on a formula for success, and offering our bit only under the heading of advice, we feel that we can not overemphasize the fact that every student will enjoy his work if he becomes interested in it. Beyond this sense of interest and duty to the required curriculum we sincerely hope the class of 1935 will take an immediate interest in the many and varied school activities which are available to them.

AT A RECENT MEETING of the Institute of International relations held at Riverside, California, Professor Eliot G. Mears of the Stanford Graduate School of Business decried our present economic setup and used the term "Economic Illiteracy," in his expression of a reason for our present abnormal state of business.

The world now finds itself in a peculiarly difficult situation for the reason that accurate knowledge is lagging too far behind day-to-day events. The economic revolution of the past fifteen years supplants a world period which is gone forever. To picture the everyday existence in our progressive civilization without automobiles, aeroplanes, electric-driven ships, radios, wireless, and mechanized industry is to dream dreams. Our American manufacturing methods and production are at stake.

This question, which squarely faces each nation, is primarily in the field of international economics. New industries established in Europe since 1918 are making good progress but the textile, coal, and heavy industries are handicapped by antiquated methods. France has made remarkable strides in the reconstruction of her terribly devastated areas, through the introduction of the most modern factory layout and machinery, when in spite of a fifty per cent reduction in the number of plants the output considerably exceeds that of 1913.

Something which has not received proper recognition in this country is the striking shift in commerce from producers goods to consumers goods. The world production of such staples as coal and wool is practically the same as in 1914, even though there are nearly 50,000 more people in the world every day than there were the day before. The simple requirements for food, clothing, and shelter are so easily satisfied that they are scarcely a problem anywhere. What we are worrying about is to be assured of the latest model of automobile, radio, or gown. We have been educated up to a social standard of living which diverts yearly many hundred million dollars from the basic industries to unprecedented demands for satisfying individual whims.

THE HUMAN SEASONS

Four seasons fill the measure of the year;
There are four seasons in the mind of man:
He has his lusty Spring, when fancy clear
Takes in all beauty with easy span:

He has his Summer, when luxuriously
Spring's honey'd cup of youthful thought he loves
To ruminate, and by such dreaming high
Is nearest unto heaven :quiet coves

His soul has in its autumn, when his wings
He furleth close; contented so to look
On mists in idleness — to let fair things
Pass by unheeded as a threshold brook.

He has his Winter too of pale misfeature,
Or else he would forgo his moral nature.

—*J. Keats*

The international economics situation reveals its plight everywhere. A hopeful source for light is to be found in the graduates of professional schools of business whose influence should be marked in the next decade or two.

AT THE RECENT CONVENTION of the Engineering College Magazines Associated, held at State College Pennsylvania, with Penn State College as the hosts, awards were presented to the member publications, who by the excellence of their issues of the past year, had merited them. The Armour Engineer takes pride in announcing that it was the recipient of several of these coveted awards. They were as follows:

First place for the best illustrated magazine.

First place for the best alumni section.

Third place for the best cover.

First honorable mention for the best editorials.

To the members of last year's staff must go the honor for the high standard set by the Armour Engineer. Through the time and effort expended by them, they produced a publication of which the students may feel justly proud. The members of the staff for the ensuing year wish to take this opportunity to congratulate those who have been responsible for the fine issues of the past, and sincerely hope that they will be able to maintain the high standard set by their predecessors.

THOMAS ALVA EDISON HAS passed away. Benefactor of mankind, master of accomplishments, this man's history will live forever. His discoveries and inventions, wondrous in their number, will perpetuate the great name of one who has done more than any one else of his time to lift a little the burden of toil and to ease a little the path of life.

His contributions to the world have left their mark so deeply that we consider them, not as such, but as essential elements of our life. How odd things would be without the telegraph system of today, without electric illumination, without a hundred and one conveniences due largely to this individual! Those factors that mean so much to happiness and contentment loom tremendously when viewed in the light of a world deprived of their benefits.

Edison has been criticized for his method of work. It has been called inefficient and wasteful; his love of experiment has been termed ignorant dabbling; his thorough perseverance, blind obstinacy. Is this so? We need but think for a moment of the definition of efficiency: The ratio of output to input. Has the value of, say, the incandescent lamp to humanity been consistent with the few thousands of dollars invested in its development by Edison? Has the sum total of increased livelihood for millions on the face of the globe been worth Edison's investment in experimental trial and error? Does the lamp industry today represent an increase over the initial investment in buying and trying? It is hard to find grounds for the indictment. In terms of actual results, the method is tremendously productive.

The world bows in reverence and gratitude as Thomas Alva Edison passes on.

College Notes

A. S. M. E.

The following men were elected to head the Armour branch of the A. S. M. E. at a meeting held last semester:

President .... H. R. Davis
Vice-President ....C. N. Cannon
Secretary ....A. Bogot
Treasurer .... J. S. McCall

The first meeting of the new school year was held Friday, October 2. Professor Peebles gave several very interesting pointers to the men in regard to society activities. Professor Roesch also addressed the society at this meeting. The need of interest and activity in the organization by each and every member was particularly urged by Professor Roesch.

A. I. E. E.

W. L. Jost was elected chairman of the Armour Branch of the American Institute of Electrical Engineers at a meeting held in D-Mission on June 1. Other officers elected were as follows:

Vice-President .... T. A. McGill
Secretary .... R. H. Frye
Treasurer .... G. L. Bonvallet

The first meeting of the present semester was held Friday, October 9. The new officers were installed at this time. For the purpose of attaining a better degree of cooperation within the society for the coming year, several committees were selected to take care of special work. The appointments were: Speakers committee, F. S. Beale, H. W. Richter, W. C. Bret, V. Kerrigan, and W. H. Lange; Membership committee, W. S. Sandstrom, A. Weston, V. J. Minnick, B. Job, and H. P. Rowe; Social committee, W. A. Stocklin, E. A. Wagner, K. Hirsh, E. E. Eberth, and R. J. Dombrowski.

A. I. CH. E.

The Armour branch of the American Institute of Chemical Engineers held their election of officers for the year 1931-32 at a meeting on May 29. The following men were elected:

President .... G. J. Stockmann
Vice-President .... S. E. Winegar
Secretary .... A. H. Helmick
Treasurer ....R. H. Blom

On Friday, October 8, the first meeting of the present year was held, at which were discussed the societies plans for the year. Speakers who have been tentatively promised are Mr. Harper of the Peoples' Gas Light and Coke Co. and also a representative of the Raymond Mill Co.

OUR VARSITY CAPTAINS

Basketball

Harvey C. Rossing

Harvey C. Rossing, a senior in the department of civil engineering, will lead the Armour basketball team for the year 1931-32. The expenditure of a great deal of time and hard work on the basketball squad for the last three years has advanced him to this honored position. His ability was first demonstrated during his freshman year at Armour, it being given recognition in

Harvey C. Rossing

the form of a basketball letter. Since that time Rossing has been a mainstay of the varsity squad and now is the holder of three letters in basketball. With such ability and enthuisasm as demonstrated by the captain, it is only natural that he will encourage the team to victories throughout the hard schedule they are now about to enter.

Rossing has lived in Chicago since his birth on November 19, 1910. After graduating from grammar school, he attended St. Ignatius High School. While here, his leadership came to the front in the capacity of manager of the athletic teams. He was manager of the basketball team both during his junior and senior years. He entered Armour in 1928 as a student in the civil engineering course. He soon became prominent in the Armour sport circles when he earned a regular position on the varsity basketball squad, this being an unusual distinction for a freshman to be able to attain. Rossing has shown also that he is a student as well as an athlete. He is a member of Chi Epsilon, honorary civil engineering fraternity, and Tau Beta Pi, honorary engineering fraternity, being president of the former. He also holds the distinction of being president of the W. S. E. and of the Honor A Society. Rossing is also affiliated with the Triangle social fraternity.

From the ability and leadership already shown by the new captain, the student body speaks as a group in expressing the belief that the Armour basketball team is well on its way to a most successful year under the guiding hand of Capt. Rossing.

W. S. E.

New officers were elected to head the Armour branch of the Western Society of Engineers at a meeting held on May 29. The new officers are:

President .... H. C. Rossing
Vice-President .... O. Eskonen
Secretary ....E. L. Byanskas
Treasurer .... H. W. Rudolf
Corres. Secretary......E. J. Wiltrakis
Student Representative...H. S. Nelson

The first meeting of the current semester was held on September 23. Plans were discussed at this meeting for the forthcoming year as to the date and type of meetings, society dues, and smokers which are to be held from time to time during the year.

F. P. E. S.

Officers of the Fire Protection Engineering Society were elected for the year 1931-32 at a meeting held on June 5. The men elected are as follows:

President .... E. A. Scanlan, Jr.
Vice-President .... W. M. Trauten
Treasurer .... J. B. Finnigan
Secretary ....J. B. Dirkers

During the past year the society was unusually fortunate in obtaining a number of interesting speakers, who presented the fire prevention and insurance line from all angles. Efforts are now being made to secure an even better array of speakers to present to the student that side of his education which is not obtainable from the ordinary text-book.

Campus Club

The Campus Club has elected for its officers, the following men:

President...............Dan I. White
Vice-President.........S. Johannisson
Recording Secretary.....C. N. Cannon

S. H. Winegar was appointed assistant executive secretary.

It has been a banner year for the Campus Club, it being fifty-eight percent larger than ever before.

The annual school chess tournament which is sponsored by the Campus Club is scheduled to begin November 29th.

Freshman Handshake Held on Oct. 7th

The opening of the social activities for the new school year was held Oct. 7th, the occasion of course, being the annual Freshman Handshake. This event is offered each year as a means by which the upper classmen can become better acquainted with the freshmen, it being practically the first opportunity for contacts between the new men and the so-called "veterans."

The evening, sponsored by the Campus Club, was entertaining as well as instructive. The men were first gathered in Assembly Hall where they were greeted with a few well-chosen selections from the new Armour band under the direction of W. H. Hornberger after which A. R. Viel, executive secretary of the Campus Club, introduced the first speaker of the evening. Professor Scherger, being the first to be called on, gave a short talk which was not only instructive but also entertaining.

The next speaker, one who has never failed to please the students at a handshake, Professor Amsbury, gave, in his own inimitable way, a number of his readings. Among them were found his old familiar "Ze Captaine of Ze Marguerite" and "The Oddissey of a Modern Inconvenience." These recitations of Professor Amsbury's have come to be an integral part of a Freshman Handshake and the evening would not seem the same if they were lacking.

The Handshake could not possibly be concluded without a word from Professor Schommer. He stressed the necessity of extra-curricular activities in order to avoid the possibility of the students' academic work becoming monotonous. After his usual quota of humorous stories, he concluded with a bit of advice to the freshmen.

The meeting was then adjourned only to be followed by an informal gathering around a keg of cider and doughnuts.

Armistice Day Assembly

The first assembly of the year 1931 and 1932 was held on Armistice Day, November 11 at 10:30 A. M. The speaker was the eminent Reverend Doctor Preston Bradley of the Peoples Church of Chicago.

Dr. Bradley is the founder of Peoples Church, an institution which today is known throughout the country. He has been active in civic affairs for a great number of years and is recognized as one of the leading citizens of the city.

Beside being the pastor of Peoples Church he is a member of the Board of Directors of the Chicago Public Library; editor of "The Liberal"; and a member of the Art Institute and the Drama League of America.

Boxing Team in Preparation for Big Season

Coach Weismann's call for boxing candidates resulted in a turnout of twenty-seven men at the first meeting on September 28. Among the new candidates were twelve freshmen and five sophomores. Eight of these are rapidly developing their style and ability so that they will make good team material. Twenty-four of the entire number have been retained as members of the boxing team.

The greater part of last year's squad is back again. Captain Sandstrom, Hoffberg, Rush, Campioni, Heckmiller, Milevsky, and Bacci form the veteran nucleus of the team for the coming season. Frank Ustryski, the captain and star of last year's boxing team, has been appointed manager for the present season.

Reading left to right; back row: Weissman (coach); Koka, Rush, Abrams, Ostheimer, McDonald, Elliott, Campioni, Ustryski (manager). Middle row: Reardon, Schmidt, Suman, Wojtasik, O'Hara, Schavilja. Front row: Kosan, Bahmar, Rigoni, Ruahan, Feinberg, Cora.

Coach Weismann has obtained new equipment to facilitate training. Regular practice sessions are held from 5:00 to 6:30 P. M. on Monday and Friday evenings in the gym. Faithful attendance has been observed by all of the team members, anxious to round into shape for a successful season.

The boxing year will officially begin in December, when Armour will meet either Loyola or a local Y. M. C. A. team. All signs point to happy hunting for the fighters.

Rifle Club

The rifle club, champions of the state last year, held several meetings this semester in order to discuss plans for the coming year and to acquaint new men with the aims and purposes of the organization.

New men have been recruited from the ranks of the freshmen, and these men coupled with the veterans of the past year assure Armour again of having a team of championship caliber.

However, it is not essential that only experienced men should join the club. Any student who wishes to gain experience in handling a rifle may become a member by paying $1.25 dues. He is then privileged to use the range and a club rifle.

Interclass Baseball and Basketball

On Friday, October 2, Armour's sport calendar was officially opened when the seniors met the juniors in an interclass baseball game. The former by reason of an eight run rally in the first inning were able to subdue the juniors and go into the finals. The following Monday the sophomores defeated the freshmen and earned the right to meet the seniors.

In the final game the seniors, behind the masterful pitching of C. Robin triumphed over the 1930 champion sophomores by a score of 3 to 1. This gave the seniors their first interclass championship.

On Tuesday, October 20, the struggle for the coveted interclass championship in basketball was opened with the freshmen meeting the sophomores, last year's champs. Although the frosh tried hard they were entirely outclassed by the speedy and coherent team work of the experienced sophomores. The final score was 27 to 5.

The second game of the tournament was played on Wednesday between the juniors and seniors, and the seniors, much too strong for the former, defeated them by a score of 22 to 15.

The championship game was played the next night with the seniors meeting the sophomores. The latter, in a spirit of revenge for their defeat at the hands of the seniors in interclass baseball, played hard and ran over the upperclassmen to the tune of 31 to 13. The stars for the sophomores were Christof, Pflum and Casey. For the seniors, Leichtenberg, Carlson, and Setterberg starred.

Swimming Team Gets Under Way

At a meeting held Tuesday, October 13, a large turnout of men indicated that the prospects for a successful season for the swimming team were very bright. Most of the members of last year's team, including Captain Andy Weston, Jack Cavanagh, Ed Byanskas, and Roy Carlstrom, are back again to defend their positions. Among the men who reported were twelve new candidates who should prove of great value.

The team practices at the University of Chicago pool, which will be open for practice any school day from 2:00 to 5:30 P. M., under the direction of Coach McGillivray.

A schedule of contests will be arranged as soon as the manager is appointed. Although only six meets were held last year, it is expected that there will be a greater number this season.

Tau Beta Pi

The officers of Tau Beta Pi, honorary engineering fraternity, are:
President..J. O. Cavanagh
Vice-President, S. M. Lind
Corresponding Secretary ..
..........R. Meagher
Recording Secretary .....
............M. Fagen
Cataloguer, W. M. Trauten
Treasurer ....
....Prof. J. C. Peebles

President Cavanagh attended the convention held at Cleveland last month. Plans are being made to bring the next national meeting to Chicago in 1933.

Sphinx

Sphinx, honorary literary fraternity, initiated thirteen men at the Lake Shore Athletic Club last June. The members are: M. R. Beal, E. W. Carlton, J. J. Casey, F. D. Chapman, H. R. Davis, M. Fagen, J. R. Jackson, C. J. Jens, J. S. McCall, H. P. Richter, W. H. Rudolf, M. J. Schinke, G. W. Schodde.

The officers elected for the year 1931-32 are:
President...............W. H. Rudolf
J. J. Casey........Secretary-Treasurer

Chi Epsilon

Chi Epsilon, honorary civil engineering fraternity, elected the following men to serve as officers for the ensuing year:
President...H. C. Rossing
Vice-President.........
........W. H. Rudolf
Secretary..C. A. Erickson
Corresponding Secretary..
...........A. A. Koch
Treasurer......O. Eskonen

Pi Nu Epsilon

Pi Nu Epsilon, honorary musical fraternity held their initial meeting of the 1931-32 year on Friday, Oct. 23. The meeting was in charge of Philip H. Korrell, the new president of the organization.

Several new ideas for stimulating the interest in music at Armour were presented and discussed at length. The activities of the numerous musical organizations for the past year were reported on and plans were formulated for the furtherance of these organizations during the coming year. Probably the most outstanding and encouraging of these announcements was that of the Glee Club, which now boasts a membership of fifty-four members, the largest enrollment ever attained by a musical club at Armour.

Watson M. Davis, A. B., M. S.

Among the new instructors at Armour is Watson M. Davis. Since graduating from Cornell College, Iowa, in 1926, where he secured his A. B., Professor Davis has devoted his entire time in the interests of mathematics. Following his graduation, Professor Davis registered as a graduate student at the University of Iowa. After the acquisition of his M. S. in 1928 Professor Davis taught mathematics at Albion College. He was there from 1928 to 1930, but spent the summer of 1929 at the University of Chicago in the capacity of a graduate student. At the present time he is working for his doctor's degree at that university. The subject of his proposed thesis, which is nearing completion, is "Contributions to the Theory of Conjugate Nets," which is in the field of projective geometry.

Ross Allan McReynolds, A. B., A. M.

Armour is fortunate in securing a person as well versed in economics as Professor Ross Allan McReynolds. Following the securing of his A. B. at the University of Missouri, Professor McReynolds taught economics at the Sterling (Ill.) High School, the North Dakota Agricultural College, and the University of Chicago. But practical work was also included in his regime, as he performed statistical and editorial work for the National Metal Trades Association. While employed for that company he acted as an employment wage statistician and helped put out monthly series of charts. Following this work, Professor McReynolds published some statistics in the "Labor Barometer."

Sholto M. Spears, B. S.

The Department of Civil Engineering has added the name of Sholto M. Spears to its list of officers of instruction. Following an inherited inclination to become a teacher, Professor Spears enrolled and completed a one year course in the Western State Teachers' College. Following the completion of this course, Professor Spears entered the University of Kentucky, in the department of civil engineering. It is interesting to note that for three of his four years at that college, he acted in the capacity of student instructor in drawing. Because of his high scholastic ability, Professor Spears was admitted to Tau Beta Pi, honorary engineering fraternity.

After graduating from the University of Kentucky in 1922 with his B. S. degree, he was employed by the Ogle Construction Company, builders of locomotive coaling stations, commercial ash handling plants, and kindred structures.

Salamander

At the final meeting of the 1930-31 school year, held last June, Salamander, honorary fire protection engineering fraternity, elected the following officers:
President...........
W. M. Trauten, Jr.
Vice-President......
....G. W. Schodde
Secretary and Treasurer
..E. A. Scanlan, Jr.

Mr. W. H. Townley is, at present, designing a new membership certificate which will be ready in the near future. Copies of the certificate will be sent to all alumni members of Salamander.

Phi Lambda Upsilon

Phi Lambda Upsilon, honorary chemical engineering fraternity, elected as its officers for the ensuing year, the following men:
President......R. H. Blom
Vice-President.........
......J. O. Cavanagh
Secretary....O. G. Linnell
Treasurer......S. M. Lind
Alumni Secretary, E. Field

A dinner and social evening was sponsored by the fraternity for all members during the latter part of May.

Pi Tau Sigma

Pi Tau Sigma, honorary mechanical engineering fraternity, recently elected the following men as officers for the coming year:
President.....H. R. Davis
Vice-President.........
........C. W. Cannon
Corresponding Secretary..
........................A. Bogot
Recording Secretary....R. F. Waindle
Treasurer................A. J. Jungels
Cataloguer................E. H. Chum

President Davis recently attended the national convention of Pi Tau Sigma, held at the University of Missouri, Columbia, Missouri.

Eta Kappa Nu

The following men have been elected to office in Eta Kappa Nu, honorary electrical engineering fraternity:
President ....
...................Morton Fagen
Vice-President........G. L. Bonvallet
Treasurer................T. A. McGill
Corresponding Secretary...........
...................V. J. Minnick
Recording Secretary....Werner Krahl
Bridge Correspondent....M. J. Schinke

Morton Fagen attended the twenty-seventh national convention held at Cornell University on October 31. The convention of 1933 will be held in Chicago under the auspices of Delta Chapter.

The Armour Alumnus

Volume VII | November, 1931 | Number 1

Alumni Officers To Be Elected In December

Annual Alumni Banquet To Be Held Dec. 17th

The annual alumni meeting will be held on Thursday, Dec. 17th, 1931. We sincerely hope every single one of the alumni will reserve this date and make a special effort to be present at this meeting. The place for this annual get-together and business meeting will be announced in the near future, whereupon each alumnus will be promptly notified by letter. Chief among the important business features of this meeting will be the election of officers for the coming year. This fact alone should stimulate the interest of every loyal alumnus as the future of the organization depends on the ones into whose hands the executive positions are placed. The attendance at this December meeting in the past few years has been encouraging but has by no means been what it should be considering the large percentage of alumni who reside in Chicago.

However, we are probably leading one to believe that the evening is to be devoted entirely to business. Do let us remove all thought of such an evening. There will be entertainment and any number of interesting bits of action for those who crave it. After all, there really is little necessity of promises as to what the evening holds in store for each alumnus, since we feel we can speak for those who have attended these meetings in the past, in saying that the annual December Armour Alumni Association banquet is the one night each year in which they crowded a maximum of enjoyment into a few hours.

Professor Nachman has been appointed chairman of the committee on nomination for the approaching election. At the time of this writing the committee personnel had not been announced by Professor Nachman.

C. W. Farrier Returns to Address W. S. E.

Clarence W. Farrier, '16 addressed the opening meeting of the Western Society of Engineers Friday, Oct. 23. Mr. Farrier who graduated from Armour in 1916 is now president of the Chicago Chapter of the American Institute of Architects and also Assistant Director of Works of the Century of Progress.

Mr. Farrier gave a very interesting speech on "Engineering Aspects of the World's Fair." Being closely acquainted with the innermost preparations for the Fair, he was able to present many of the facts which will be unique in the exposition field. In short, he explained that the purpose of the coming Fair is to show the progress of scientific research in its applications which better the living conditions of people.

Elsewhere in this issue of the Engineer will be found an article by Mr. Farrier on one particular phase of the engineering work connected with the Century of Progress.

Professor Moreton Now In Charge of Placement Bureau

Mr. David P. Moreton, E. E. '06, professor of direct and alternating current machinery at the Institute has been made placement councilor to succeed Donald Richardson, who has been granted a year's leave to study

David P. Moreton

for his doctor's degree at the University of Chicago. As placement councilor, Professor Moreton will have charge of the bureau of employment and will assist graduates and former students in obtaining positions, as well as employers who are looking for a certain type of man to fit in their organization. Graduates and former students who are looking for positions should get in touch with Professor Moreton by appointment if possible. Phone Victory 4600 or write him a letter in care of the Institute.

Dean Monin Passes Away

The sad news of the death of former Dean, Louis C. Monin, was received last week by Dr. Raymond. Dean Monin passed away at his home in Zurich, Switzerland on Sunday, November 8.

The former Dean was known to all of the alumni among whom he made hundreds of friends during his long service at Armour.

We regret very much to publish notice of the recent death of Ellis S. Echlin, '16, who passed away August 20th, 1931, at his home in Union, Illinois.

Plans For Alumni Reunion Now Being Made

Plans for the alumni reunion which is to be held sometime in the spring of the year, are now being started, in an effort to make this second reunion even more elaborate than the first which was held in 1931. The reunion last year was in the hands of the class of '06 and the arrangements were taken care of by a committee headed by Professor Moreton. The plan is to have this year's reunion in the hands of the class of '07, thereby following the precedent set last year in having the reunion fostered by the class whose 25th anniversary it is.

These alumni reunions, while sponsored by a particular class, are open to all Armour Alumni. Last year's reunion was an extraordinary success considering the fact that it was the first class or alumni reunion to be given a trial. There were some forty-seven members of the class of '06 present form all parts of the country. Headquarters were established at the Palmer House, visits were made to the Institute, and old acquaintances were renewed on sight. Efforts are being made, this year to arrange the date of the reunion in accord with the Institute Open House Night, thereby giving the alumni an opportunity to view the progress the Institute has made in the years interviewing since their graduation. The date has not been decided upon definitely as yet, however, all alumni will be notified through the pages of the Engineer as to the exact date in a later issue.

At this time we would like to request all members of the class of '07 to get in touch with either Professor Schommer, at the Institute or Mr. Hirsh, at 4507 N. Campbell Ave., Chicago, in regard to the choosing of a committee to handle the arrangements for the reunion.

William L. Hafner, C. E., '31, was one of the instructors at the civil engineers summer camp located at Trout Lake, Wisconsin.

Alfred L. Mell, Arch., '31, recently returned from Europe where he spent the summer traveling and devoting a great deal of his time studying architecture. He visited England, France, Germany, and Austria, making short stays in Vienna and Munich. Mell, who graduated only last June, was a member of Scarab, honorary Architectural fraternity, and winner of the Art Institute prize in his senior year which carried with it a sum of money to be used in traveling.

Alumni Pay Tribute to Phillips

Proof that the memory of Dr. Alfred Edward Phillips, who passed away last semester, has not passed from the minds of Armour graduates, has been amply furnished by past members of the Department of Civil Engineering. Following the death of Dr. Philips, graduates of that department were informed by letter of the unfortunate happening and also of the succession of his position as head of the department by Professor Melville B. Wells. Since then, the latter has been receiving numerous replies to these letters. Proof of the love and respect which endeared Dr. Phillips in the hearts of his students is not difficult to find. Mr. H. M. Sharp, '05, writes from his office at Toledo, Ohio, where he is vice-president of the France Stone Co., "This statement in part, 'Men who had the privilege of studying under Professor Phillips will remember his profound scholarship, his sympathetic interest in his students, his thoughtfulness and his eagerness to be helpful, his highly developed sense of humor, his wonderfully pleasing personality, and, above all, his devotion to high ideals,' so truly sets forth his lovable personality as to leave one to wonder what further ideals and achievements there are to strive for."

Something higher than love, something deeper than respect seems to be contained in the letter of Mr. W. Oldenburger, '14, who, from Mexico eulogizes, "To us and all he was "PA." How well I recall his many expressions of humor, his keen insight to those of us who could not grasp his many theories—. He always looked for the best in others and gave the best he had. How I recall his fatherly attitude to all of us while at Summer Camp. He never lacked appreciation of earth's beauty and never failed to express it to all of us. There could be no question of doubt; in his passing, Professor Phillips left the world better than he found it."

His highly developed sense of humor can well be remembered by Mr. Raymond Zack, '11, who is now District Engineer for the Iowa State Highway Commission. Mr. Zack writes, "I remember him best in the class room when something or other was said, his face would light up with that rare smile of his. He enjoyed a bit of fun as much as anyone."

That the world has lost not only a lovable character, but a scholar of exceptional ability is evidenced in the remarks of Mr. Jos. J. Wallace, '22. "The profession has lost a valuable man; a gentleman and a scholar."

Mr. R. F. Stellar, '29, Assistant Civil Engineer in the War Department feels that "his connections with the Institute have certainly earned for him a very prominent part in the history of the school."

Mr. Stanley W. Newman, '17, affectionately remarks of "Pa" Phillips, "I was very sorry to hear of his death and will always cherish the pleasant memories associated with him."

With the passing of a personage so beloved, so scholastic, so sympathetic, so thoughtful, so eager to help, so enriched with high ideals as was Professor Phillips, it was indeed a difficult task to find a man capable of stepping into Professor Phillip's vacant chair. But Armour was fortunate in having in its faculty a professor amply fitted to maintain the high standard which is enjoyed by the Civil Engineering Department. He is Professor Melville Baker Wells. Proof of the efficiency of Professor Wells may well be seen by the numerous messages of congratulations which have been received. Mr. Eugene F. Hiller, '06, after remarking on Professor Phillips death, states, "At the same time please accept my congratulations and hopes for your future success at the Institute."

Mr. Victor S. Persons, '02, quotes, "I know that nothing would have pleased him better than to know that you (Professor Wells) are taking up his work and heading the Department of Civil Engineering. You certainly have the loyalty and best wishes of all your former students." Space will not permit the quoting of all the complimentary phrases which are contained within the numerous letters, but it is significant to state that every correspondence received approved in no small terms of Professor Well's appointment.

Peek Becomes Member of Armour Faculty

Among the graduates who have returned to Armour appears the name of Professor Peek. But this time his attendance is in the role of instructor of elementary machine drawing and descriptive drawing rather than that of student. Professor Peek obtained his B. S. degree at Armour in 1916 in the Department of Architecture. Following graduation he taught elementary machine drawing and descriptive drawing at Georgia Tech. For several years following this teaching, Professor Peek was employed by various architectural and engineering companies in Atlanta and in Chicago. While in the employ of these companies, his work was that of drafting and structual design. When asked if he had a hobby, Professor Peek solemnly replied that his hobby was reading Greek tragedies.

Break, Break, Break

Break, break, break,
On thy cold grey stones, O Sea!
And I would that my tongue could utter
The thoughts that arise in me.

O well for the fisherman's boy,
That he shouts with his sister at play!
O well for the sailor lad,
That he sings in his boat on the bay!

And the stately ships go on
To their haven under a hill;
But O for the touch of a vanish'd hand,
And the sound of a voice that is still!

Break, break, break,
At the foot of thy crags, O Sea!
But the tender grace of a day that is dead
Will never come back to me.
—*Lord Tennyson*

R. E. Freeman Returns to Lecture On Field Work

After spending several years away from the old familiar halls of the Institute, R. E. Freeman, '25 returned, this time not in the roll of one seeking knowledge but rather of one radiating it. On Friday, October 23rd the Fire Protection Engineering Society was treated to a lecture by Mr. Freeman on the interesting subject of Sprinkler Equipments. There could be no better qualified man to present such a lecture to the students as Mr. Freeman has been in Sprinkler work since his graduation in 1925 and is at the present time manager of the Sprinkler department of the Illinois Inspection Bureau.

Mr. Louis Hirsh, Ch. E., '14, secretary of the Armour Alumni Association states that he would like to make this year more active for the alumni than any past year. Any suggestions to bring about this end would be greatly appreciated by him, as would the change of address of any of the alumni.

Grover Keeth, M. E., '06, has been appointed chief engineer of the Wausau Paper Co.

Lester O. Castle, F. P. E., '27, is now working for the Milwaukee Underwriters.

Abraham Kuklin, Arch., '30, at present is studying at the Chicago Architectural Sketch Club in preparation for the coming Architectural State Board examination.

Harry Turk, Arch., '29, has opened an architectural office on E. Jackson Blvd. The office goes under the name of King, Turk & Cris. Turk is also a professor of freehand at Crane College.

A third member has been added to the happy home of the Brockmann family, the newest addition being a baby girl. The proud father is one well remembered in Armour basketball circles, Erwin W. Brockmann, F. P. E., '29, who is now making his home in South Bend, Indiana, where he is under employment at the Indiana Inspection Bureau.

Vernet V. Poupitch, M. E., '29, has successfully completed the examinations required by the U. S. Government for a commission in Aeronautics and will participate in the commencement exercises to be held at March Field, Riverside, California on June 18 of next year.

Benjamin F. Morrison, C. E., '22, now holds the position of Engineer of Contracts and Specifications with the Chicago Board of Local Improvements.

David G. Greenfield, F. P. E., '28 crossed the matrimonial divide during the month of October. Mr. and Mrs. Greenfield are now making their home in South Bend, Indiana where Dave is employed by the Indiana Inspection Bureau.

Al De Long, Arch., '31 recently annexed the $1200 traveling fellowship offered by the Architectural Sketch Club.

Former Armour Professor Dies Suddenly

Dr. Henry Barret Learned, 63, eminent historian and guest professor of history at Stanford University died at his home in California on Oct. 11th. His death was sudden and came as a blow to his many hundreds of friends.

No doubt, Dr. Learned will be remembered by many of the older Alumni of Armour Institute having taught classes at the Institute in the years from 1893 to 1896. During his short professorship at Armour, Dr. Learned made many friends both among the faculty and the students and it is with regret that the Engineer announces his death to the alumni.

Dr. Learned took his guest professorship at Stanford University only Oct 1st and was to have taught history for a semester. He resigned as president of the board of education of the District of Columbia two months ago.

Dr. Learned was born at Exeter, N. H., March 21, 1868. He held degrees from Harvard, Yale, Chicago, and Leipsig universities. He was the author of several books and articles on historical and political subjects, including one on "The President's Cabinet." He served with the U. S. department of justice, bureau of investigation, from 1917 to 1919.

During his short stay at Armour, Dr. Learned conducted sophomore classes in History and Civics.

Lost?

In the course of years, and as a consequence of a continual change in addresses of alumni, the secretary of the Alumni Association has lost track of a number of men. From time to time important announcements are sent to the alumni and it is essential that they receive them. Below will be found a list of those whose addresses are not now known and it is hoped that anyone who knows of the location of these men will notify Mr. Hirsh, Secy.-Treas., Armour Alumni Association, 4507 N. Campbell Ave., Chicago, Illinois. Cooperation on the part of the alumni to this extent will mean very little effort to them whereas it will be greatly appreciated by the Alumni Association.

G. L. Andre, '18
W. J. Baer, '10
Roy Barber, x-'31
A. B. Benedict, '04
R. J. Blasi, x-'31
W. E. Bliss, x-'31
C. C. Blume, x-'25
P. L. Bradford, '11
L. Bramson, x-'31
H. V. Burke, '28
A. A. Ehrlich, x-'31
F. D. Farrar, '14
W. F. Fryburg, '13
F. O. Godfrey, '10
Wm. Jervis, x-'31
C. F. Kautz, '24
H. S. Keeler. x-'11
F. Konicek, Jr., '11
G. Kuta, x-'31
H. P. Langstaff, '12
J. R. Lossman, '30
G. O. Melby, '26
R. M. Montgomery, x-'26
C. P. Pelta, x-'23
F. L. Pond, x-'16
E. J. Schmidt, '11
W. C. Schmidt, x-'30
C. H. Simmons, x-'30
W. H. Vickers, '24

Robert I. Wishnick, Ch. E., '14, returned to his home in Brooklyn, N. Y. early this summer from a trip abroad. While visiting various interesting points in Europe, Wishnick stopped at Zurich Switzerland to have a short visit with Dean Monin.

Juttemeyer Dies Suddenly

It is with deep regret that we announce the passing of Walter Leo Juttemeyer, M. E., '15. His death came as a result of an automobile accident on the night of October 15. With his wife and 13 year old child, he was driving from his home in St. Louis to Ohio when, at a dangerous curve near Indianapolis, the car crashed

Walter L. Juttemeyer

head-on into a truck which carried no lights. The three occupants were injured, Juttemeyer critically. The next day he died in the City Hospital of Indianapolis.

Walter Juttemeyer graduated from Armour in 1915. After nine months at the Standard Oil Company refinery in Alton, he accepted a position with the Alcoa Ore Co., located in East St. Louis. At the time of his death, he was master mechanic.

He is survived by his wife, his daughter, Helen Virginia, his parents, and four brothers.

Alumni to Meet Varsity Squad in Basketball Game

The annual basketball game between the Alumni and the Varsity is scheduled to take place on December 1st. All grads who are still adept at the art of tossing a basketball through the old familiar hoop are requested to get in shape for this event.

In the past the alumni have never failed to give the undergraduates a real battle and another grudge battle such as those which have gone before is anticipated this year. The alumni, as always, are an unknown power until game time, however, the varsity is reputed to be fast shaping into a team which the grads will find hard to beat. The alumni game will be, as usual, the first game on the year's schedule, thus, it will be in the form of a test for them.

Varsity Defeats Alumni By 9 to 3 Score

Pepped up by a successful season, the Varsity baseball squad romped over the Alumni in a comedy attraction at Ogden field just before the close of school last May. The Alumni were by no means a match for Mr. Krafts ambitious young men, who led by Pepe, Omiecinski and Lynch bounced base hits off the wall until the Alumni fielders were dizzy.

The Alumni started the game off badly by committing a number of costly errors in the first inning which coupled with three base hits permitted two runs to score. This lead was materially increased in the next three innings.

However badly the Alumni were beaten they must be handed credit for their courage and fortitude in turning out for the annual game in which they invariably are the underdogs. Being a get-together-quick team, they cannot be expected to furnish the stiffest of competition to a team of much younger men, well coached, and with a season's training only just behind them.

At the end of seven innings both teams were ready to call it a halt and when the festivities ceased the official scorer declared the Varsity squad the victors by a score of 9 to 3. Once more the Alumni were credited with an actual defeat but with a moral victory.

Wanted—More Letters Like This

A letter, of rather recent date, is now in the hands of Mr. Hirsh from B. H. Jarvis, '13, whose home is located in Arlington Heights, Illinois. Mr. Jarvis displayed what is probably the most touching bit of spirit yet shown by an alumnus of Armour Institute when in his letter were contained the words, "Too bad I have not more lives to give for the Association." It might be said that Mr. Jarvis having already paid for a life membership in the Alumni Association, has again expressed his desire to contribute to the association and become what might be called a "second life member."

As a matter of general information to those who perhaps have been unaware of what is done with the money received from these life memberships, it might be said that it is put to a most worthy cause. The funds received are put directly into the Alumni Student Loan Fund from which they are available to undergraduate students at the Institute who are in need of financial aid so as to be able to complete their course of study. No doubt, many of the alumni who are now in the field would have welcomed, heartily, such a fund when they were in their student days.

Alan C. Tully, C. E., '28, was married during the course of the last summer and has now changed his home from Lansing, Michigan to New York where he will become a field man for the Ethyl Gasoline Corporation.

Robert W. Van Valzah, M. E., '21, and Benjamin F. McAuley, M. E., '09, are both employed in the mechanical engineering department of the Western Electric Co. in Hawthorne.

The Hoover Dam

(*Continued from page 7*)

ly at them and there has been no appreciable erosion. Concrete drops typifying the actual conditions of the inclined shaft have been subjected to a sliding velocity and there has been no erosion and nothing more has happened than a discoloration of the surface.

After the completion of the tunnels the work of diverting the river begins and to accomplish this upper and lower cofferdams will be built. These cofferdams are always looked upon with suspicion by engineers; especially so in the Colorado. After their acceptance by the government, the designers will assume the risk in the event of a major disaster. These cofferdams will be built to withstand any normal flood but a flood such as in 1884 would sweep them off their foundations as so much straw.

The up-stream cofferdam will be of the earth and rock-fill type, the upstream earth-fill slope being protected by a 3-foot rock blanket covered with 6 inches of reinforced concrete paving.

A water tight cut-off wall will be formed in the river bed by steel sheet piling driven in a trench at the upstream toe. The downstream cofferdam will also be of the earth and rock-fill type, the downstream slope being protected from eddy actions by a rock barrier. This rock barrier will consist of a massive embankment of 127,000 cubic yards of dumped rock and will be placed downstream from the downstream cofferdam. After having served their purposes the downstream cofferdam and rock barrier will be removed from the river channel by the contractor. Some idea of the magnitude of these cofferdams which are sizable structures in themselves can be seen by the fact that in the two cofferdams there will be placed 798,000 cubic yards of earth and 227,000 cubic yards of rock. The upper dam alone will be some 80 feet in height with a top width of 70 feet.

With the river diverted and its waters held back by the cofferdams, the work on the solid foundation will begin. This excavation alone is about 180 feet deep and means the removal of 1,800,000 cubic yards of sand and rock. With this done, the loose rock of the side walls removed, and the grooves cut into the walls so that the arch dam will abutt squarely against them, the placing of 3,500,000 cubic yards of concrete will begin. It will be the largest single mass of concrete ever placed and a monument to the ingenuity of our engineers.

The dam will be of the massive concrete arch-gravity type in which the water load is carried by both gravity action and horizontal arch action. It will be about 1,180 feet long on the crest and about 730 feet in height above the lowest point of foundation. It will have a width up and down stream of about 45 feet at the top and 650 feet at the base. The water surface of the river will be raised some 580 feet. The lake which the dam will make will be 115 miles long and 580 feet deep. It will take two years' flow of the river, or enough water to cover the state of New York to a depth of one foot. It will be not only the largest artificial lake in the world, but has thirteen times the capacity of the great reservoir on the Nile. The radius of curvature of the axis will be about 500 feet. Of the total 4,400,000 cubic yards to be placed in all the works about 3,400,000 cubic yards of the concrete will go into the dam. A cut-off trench will be excavated in the foundation rock along the upstream toe. The foundation and abutment rock are to be drilled and pressure grouted, the holes being located at 5-foot intervals in one line in the trench. Grout holes will vary in depth up to a maximum of about 150 feet. The dam will contain a very complete drainage system, with a main drainage gallery parallel to the axis of the dam, connecting with radial drainage conduits discharging at the downstream toe of the dam.

The setting of this enormous mass of concrete presents a problem that some of the leading civil engineers and concrete experts of the country have been engrossed in for months. The critical question of how to obtain an integral mass and avoid cracking, which outside of foundation uncertainties is the most serious defect in modern concrete dam construction, must be solved. Both shrinkage (due to moisture change) and thermal action (due to heating of the concrete while it is setting and subsequent cooling and contracting) are factors here. It is noteworthy to mention here that dry mixtures are to be used in all the concrete work, to obtain high strength and density, and accordingly bucket placing is specified. In general, the proportion shall be such as to produce concrete having an ultimate compressive strength at the age of 28 days, varying from not less than 2,500 pounds per square inch for the mass concrete of the dam, to not less than 3,500 pounds per square inch for slabs, beams, and other thin reinforced members. When concrete sets a large amount of chemical heat is generated. With present day cements it causes a rise of temperature of as much as 70 degrees F. As this heat disappears shrinkage occurs, causing cracks. In dams of ordinary size, this heat is dissipated at about the date the dam is completed, but in the case of the Hoover Dam the mass is so enormous and the distance the heat has to be conducted is so great, that if it were built as a solid mass it would take 100 years for all of this chemical heat to be lost. To hasten this cooling the dam is to be built in a series of columns 50 feet square, the joints between which are to be grouted under pressure later on, thereby creating a solid arch. These columns will be cooled by the insertion of pipes filled with a cooling solution. After any portion of concrete in the dam or tunnel has set for six days it is cooled to 72 degrees F. A complete refrigeration plant is to be installed in three units. They are so arranged that they can be run singularly or in groups. This plant sends the cooled water through the

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Young And Old

When all the world is young, lad,
And all the trees are green;
And every goose a swan, lad,
And every lass a queen;
Then hey for boot and horse, lad,
And round the world away;
Young blood must have its course, lad,
And every dog his day.
When all the world is old, lad,
And all the trees are brown;
And all the sport is stale, lad,
And all the wheels run down;
Creep home, and take your place there,
The spent and maimed among;
God grant you find one face there,
You loved when all was young.

—*C. Kingsley*

ETHICAL

Small Brother: "I just saw you kiss my sister."
Blaise: "Here. Keep still; put this half dollar in your pocket."
Small Brother: "Here's a quarter change. One price to all—that's the way I do business."

"Black chile, does you all know what deceit am?"
"Suttingly I does, mammy."
"Den what is it?"
"Well, when I leans ovah an' heahs somthin' rip, I knows dat's de seat."

Voice Over Phone: "Is this the lady who washes?"
Society Snob: "Indeed! I should say not."
Voice Over Phone: "Why you dirty thing."

Employer (furiously): "Why hasn't this job been done? It's nearly a month since I told you to do it."
Office Boy: "I forgot, sir."
Employer: "Forgot! Forgot! Suppose I forgot to pay you. What would you say?"
Office Boy: "I should come and tell you at once; not wait a month and then kick up a fuss about it."

"I hear you advertised for a wife. Did you get any replies?"
"Sure. Several hundred."
"What did they say?"
"Oh," they all said, "You can have mine."

TURN 'ER OVER

Farmer: "I thought you said you had plowed this field?"
Hired Man: "No; I only said I was thinking about doing it tomorrow."
Farmer: "Oh, I see, you merely turned it over in your mind."

Aspirant for School Golf Team: "Well, coach, how do you like my game?"
Prof. Leigh: "I suppose it's all right but, personally, I like golf better."

Lady Visitor: "And how were you hurt, my good man?"
Soldier: "By a shell."
Lady: "Did it explode?"
Soldier: "No, ma'am, it crept up and bit me."

TOO COLD

Mrs. Old-timer: "It says here in the paper that the young girls to-day are abandoning all restrictions."
Mr. Old-timer: "Well, I'd better not catch Mabel without hers on."

"A New VEHICLE"

Book Agent to Farmer: "You ought to buy an Encyclopedia, now that your boy is going to school."
Farmer: "Not on your life! Let him walk the same as I did."

Moment of Inertia

SUPERIOR INFERIORITY

"What's all the fuss in Ogden Field?" asked one of the Profs.
"Why the doctor's just examined the freshmen, and one of the deficient boys is mopping the field with the perfect kid," replied a helpful student.

WELL PERHAPS

"Robert," said the teacher, to drive home the lesson on charity and kindness, "If I saw a man beating a donkey and stopped him from doing so, what virtue would I be showing?"
"Brotherly love," said Bobby.

You might say hockey-sticks cover a multitude of shins.

PREPAREDNESS

An old maid went to have her picture taken and the photographer noticed her tying a piece of clothes line around the bottom of her skirt.
"What's the idea of that?" he asked. "I can't take your picture that way."
"You can't fool me, young man," said the old girl. "I know you can see me upside down in the camera."

Then there was the street cleaner's daughter who swept me off my feet.

"When did the robbery occur?" the cross-examining lawyer asked the witness.
"I think—," he began.
"We don't care what you think," remarked the lawyer, "answer the question."
"Well I may as well get off the stand then," said the witness, "I can't talk without thinking; I'm no lawyer."

Prof. Scherger, on his last trip to Europe: "This beautiful dining room goes back to Louis the Fourteenth."
Tourist (sympathetically): "Yes, I know how you must feel. My whole living room set goes back to Sears Roebuck, the fifteenth."

Wife: "Didn't I hear you come in last night, from your lodge? Didn't the clock strike two as you came in?"
Other Half: "Well, you see it was this way; the clock started to strike eleven and I stopped it so as not to awaken you."

INFECTIOUS

Confused Shopper: "I want a pair of spec rimmed hornicles—I mean sporn rimmed hectacles — dash it! I mean heck rimmed spernacles—"

Floor Walker: "I know what you mean, sir. Mr. Brown, show the gentleman a pair of rim sperned hectacles."

Boss: "You're late this morning, Rastus."

Rastus: "Well sah, when Ah looked in de glass dis mornin' Ah couldn't see mahself there, so Ah thought Ah'd gone to work. Some time later, Ah discovered dat de glass had dropped out of de frame."

The Hoover Dam

(*Continued from page 22*)

pipes laid in the concrete. This refrigerating plant operates to reduce the temperature of a flow of 2,100 gallons of water per minute from 40 to 47 degrees. The average rise of setting is 40 degrees F. above placement temperature. The amount of heat to be removed is about 700 B. T. U. per degree per cubic yard of concrete. In July the mean temperature is 93.9 degrees F. The maximum temperature then of the concrete will be 133.8 degrees. It is estimated that the cooling water must be applied for 2.4 months to reduce the temperature of the concrete to 71.7 degrees. This expedient which perhaps is due in part to the hot summer climate at the site has its virtues untried but at least it can do no harm. It is pre-eminently the most original feature of the dam. Three inch standard steel pipes and fittings will be used. A total of 800,000 linear feet of 150 miles of pipe in lines 10 feet apart involving the use of 16,000 couplings it is estimated will be needed to complete this part of the construction.

None of the columns that the dam is being built of will be carried up more than 30 feet at a time. They will be carried up so that the working surface will be unequal. After they have been carried up 30 feet, the space between them will be filled with grouting. Block construction has been adopted in many dams since Schassler's Crystal Springs dam of 40 years ago; but as now used, with bitumen-painted sides fully keyed, and subsequent grouting, it is unmistakably a new departure.

In addition to the drainage galleries there will be a number of inspection galleries. Two elevator shafts will connect the two wings of the power house with the top of the dam.

The dam completed, the matter of the disposal of the water that must pass the dam is taken care of by the construction of two spillways, one on each side of the river. Each of these will consist, in downstream order, of a 50-foot by 50-foot Stoney gate, a concrete overflow crest about 700 feet long, a reinforced concrete-lined open channel that will use a part of the 35,000,000 pounds of bars and rails that will be used on the job as reinforcing steel, and a 50-foot diameter concrete-lined inclined tunnel, through which the water will pass into the outer diversion tunnel. Having served its diverting purpose this outer tunnel will be plugged with concrete immediately upstream from its junction with the inclined spillway tunnel, and the downstream portion will then become a part of the spillway system. It is estimated that the spillway will require 1,012,000 cubic yards of open-cut excavation and 144,000 cubic yards of excavation in the inclined tunnels.

Roadways

One road leads to London,
One road runs to Wales,
My road leads me seawards
To the white dipping sails.

One road leads to the river,
As it goes singing slow;
My road leads to shipping,
Where the bronzed sailors go.

Leads me, lures me, calls me
To salt green tossing sea;
A road without earth's road-dust
Is the right road for me.

A wet road heaving, shining,
And wild with seagulls' cries,
A mad salt sea-wind blowing
The salt spray in my eyes.

My road calls me, lures me
West, east, south, and north;
Most roads lead men homewards,
My road leads me forth.

—*John Masefield*

The last consideration in the setting of this great dam is the outlet works on each side of the river and these will consist of two separate systems, each being regulated by a cylinder gate in the bottom of the intake tower, the two towers being about 185 feet apart in a direction parallel with the river. The system regulated from the upstream intake tower will consist, in downstream order, of the tower with a cylinder gate 31 feet in diameter, discharging into a 30-foot diameter inclined tunnel connecting with the inner diversion tunnel; the upstream tunnel plug in the diversion tunnel with temporary slide gates; the inner diversion tunnel below the upstream tunnel plugs; the downstream lower and upper canyon-well outlet gates and needle valves; the downstream tunnel plug with outlet gates and needle valves installed therein; and the 50-foot by 50-foot Stoney gates at the outlet end of the inner diversion tunnels.

The system regulated from the downstream intake tower will consist of the tower with its cylinder gate 31 feet in diameter discharging into a 30 foot diameter horizontal penstock tunnel, leading to the upstream lower and upper canyon-wall outlet gates and needle valves. Power penstocks divert from each system. The lower and upper canyon-wall outlet gates and needle valves on each side of the river are housed in separate buildings, and in each of the four buildings there will be eight 72-inch needle valves for discharge control.

$38,200,000 will place a U shaped structure of concrete and steel immediately downstream from the dam. A continuous, firm power output of about 663,000 horsepower, based on 83 per cent plant efficiency, and 10 per cent maximum shortage will be taken from the main structure, constructed across the downstream toe of the dam and each of its wings, which extend about 500 feet and accommodate at least six and possibly eight, main power generating units, together with transformers, switching and control equipment, and auxiliary apparatus.

4,330,000,000 kilowatt-hours will be available yearly but this amount will decrease each year thereafter by 8,760,000 kilowatt-hours, as a result of upstream development.

History is in the making, out there, where some 4,000 men are forming the advanced guard of work on what the Engineering News-Record describes as, "The most advanced, the boldest and most thoroughly studied hydraulic enterprise in engineering history. With 5,000,000 cubic yards of concrete, 30,000 tons of structural steel, and over seventy tons of grouting holes, with rock tunnels ranging from fifty to seventy feet in diameter, and 2,000 tons of needle valves, the structure that is to be set in the path of the turbulent Colorado in a sheer walled narrow gorge at the bottom of an inaccessible desert canyon in the remotest region of the United States constitutes a work ranking with the greatest ever attempted by human hands."

Illimination Features of the Century of Progress Exposition

(*Continued from page 4*)

turesque lighting schemes for certain areas of the grounds are being planned by the illumination engineers.

Of these perhaps the most spectacular now under contemplation is a simulation of one of Nature's grandest dramas—the manufacture of artificial lightning in the great court of the Electrical building now rising on Northerly Island. A generator capable of developing 5,000,000 volts, or the equivalent of a natural lightning "stroke" may be erected in the center of the court. Across two giant electrodes high in the air, this lightning may streak with all the violence and crash which accompany natural lightning and its resultant thunder. By the use of chemicals and salts the color of the lightning strokes might be tinted in green, blue, red and yellows, achieving startling results.

In the court behind these lightning displays, eight electrical cascades will play at night. In appearance they will be like waterfalls gushing down sixty feet from the walls of the Electrical building. As the cascades descend, they will vary in color and intensity.

Another highly dramatic feature will be the proposed Tower of Water and Light. This tower may be located near the southern extremity of the lagoon between Northerly Island and the mainland. The tower will be a winged shaft rising hundreds of feet into the air, of a black basaltic color. Down from the top finely subdivided geysers of water may rush in variance with the laws of nature governing natural geysers, but giving a general direction to the water and counteracting its dispersion by high winds. The black material of the tower will provide an effective background against which the water may be lighted either from below or behind, thus causing the water to shimmer and sparkle in its descent. An entirely new method of lighting may be employed which consists of placing the light projectors head-on toward the spectator, rather than inverting them, as is the case with illuminated fountains now in use.

Innovations are being planned in lighting the dome of the Travel and Transport building, already standing on the Fair grounds. In this scheme the four great windows in the dome which are each approximately 50 feet high by 32 feet wide and glazed with unpolished glass, will be utilized for a highly effective illumination spectacle. It is planned that a continuous inside wall finish running around the inside of the dome's structure will screen the space behind these windows. Aluminum disks will be hung from a rack, acting as scintillators. Colored lights playing on these disks from behind will produce a kaleidoscopic design in colors projected from the windows at night.

The spectacle of luminescent surfaces and decorative elements in incidental places throughout the grounds may be one of the most charming phases of the illumination scheme. Ultra violet light tubes activating the surfaces treated with sulphite paint are used to produce these luminescent effects. Experiments have shown that artificial flowers treated with sulphite paint can be made to glow and sparkle when they are subjected to the light rays from these tubes.

The interiors of all of the exhibition buildings, it is planned, will be lighted artificially, hence no windows are being provided for this purpose. Control of the interior lighting and of its volume and intensity regardless of the weather outside or time of day will thus be in the hands of the exposition officials.

A highly novel development in interior lighting will be the projection of murals and decorative designs on plain wall surfaces through the use of light. These may be of varied shapes and tints. They may be stationary or in movement with design following design across the walls. This mural treatment by colored lights may be employed in the Travel and Transport building, in the Hall of Science and in other special places.

A forecast of how some of the exterior illumination of the 1933 World's Fair may be developed can already be found in the night lighting of the main entrance to the Administration building.

This entrance unit is formed by fourteen V-shaped pylons rising 45 feet and colored white. Each panel of the pylons is five feet wide. At the base of the front section, pits are provided and in each pit are two 300-watt wall floodlights, projected through dark blue colored screens. In the soffits provided at the top of the pylons, two 500-watt lights over colored stencil designs between plate glass are used to project colored designs on the top part of the V-panels. The color design thrown down from the top is a peacock tail motif in pastel shades of yellow and green, blendin into the blue color at the bottom.

Month by month new designs and schemes of illumination are being developed and perfected by the engineers on the staff of A Century of Progress. Two years hence in its completed entirety, the 1933 World's Fair will be as much a dramatization of the phenomenal progress in the art of illumination in past years as it is of the advancements in architecture, science, art, and industry.

The Terror Of Death

When I have fears that I may cease to be
Before my pen has glean'd my teeming brain,
Before high-piled books, in char-act'ry
Hold like rich garners the full-ripened grain;

When I behold, upon the night's starr'd face,
Huge cloudy symbols of a high romance,
And think that I may live to trace
Their shadows, with the magic hand of chance

And when I feel, fair Creature of an hour!
That I shall never look upon thee more,
Never have relish in the faery power
Of unreflecting love—then on the shore

Of the wide world I stand alone, and think
Til! Love and Fame to nothingness do sink.

—*Keats*

Engineering News

(Continued from page 13)

With the approach of darkness, the photo-electric tube operates a relay which closes the street circuits. When daylight appears, the contact is opened and the lights are extinguished. Cloudy or foggy atmospheric conditions will, of course, act to operate the light-sensitive cell. Increase in safety and greater convenience are the outstanding advantages of this automatic light control system. This is indeed a far cry from the lamplighters of not so many years back.

World's Largest Water Turbines

At Ryborg-Schwarstadt on the Rhine river will soon be completed an installation of what will be the world's largest water turbines. There will be four of the turbines, located in an enormous power house. The power house, acting as the dam will span the entire width of the river. These turbines will provide electrical energy for the industries located in the surrounding territory of Switzerland.

Each of these Kaplan turbines with its axle and fly wheel weighs 280 tons, which makes the installation an engineering feat in itself. The turbines are lowered into the opening provided by means of a large over head traveling crane. The generators are built into the turbine so as to make each a single unit. The turbine is capable of delivering 40,000 horsepower, which will revolve the generator shaft at approximately seventy-five revolutions per minute. The capacity of absorption of each turbine varies form 10,700 to 300,000 liters of water per second.

ARMOUR TECH ATHLETIC ASSOCIATION

Treasurer's Report, College Year 1930–31

Receipts

Cash Balance, September, 1930			$ 7,682.21
162 Senior Student Fees, at $7.50 1st Semester		$ 1,215.00	
660 Student Fees, at $8.50 1st Semester		5,610.00	
		6,825.00	
Less Class Dues		660.00	6,165.00
159 Senior Student Fees, at $7.50 2nd Semester		1,192.50	
638 Student Fees, at $8.50, 2nd Semester		5,423.00	
		6,615.50	
Less Class Dues		638.00	5,977.50
Accounts Receivable			147.54
Surplus			12.97
Interest on Bank Balance			301.02
			$20,286.24

Expenses

"A" Blankets		151.88	
Armour Engineer	$2,140.95		
Advertisements and Subscriptions	1,348.87	792.08	
Armour Tech News	1,604.90		
Advertisements, Subscriptions, etc.	1,377.61	227.29	
Baseball		55.67	
Basketball		270.00	
Boxing		101.40	
Cycle	3,054.80		
Adv., Sale of Books and Donations	1,411.40	1,643.40	
Directors and Coaches		4,881.00	
General Expense		511.30	
Golf		350.00	
Medical Expense		77.00	
Musical Clubs		385.01	
Rifle Club		31.94	
Swimming		73.41	
Tennis		465.33	
Track		756.30	
		$10,773.01	
Cash Balance	$10,418.64		
Less Class Balances	905.41	9,513.23	$20,286.24

The Well Rounded Engineer

(*Continued from page* 11)

ed to conceptions of rigid accuracy and the resources of mechanics; most of all to the new technology called into existence by the need of the young instrument maker for any accuracy of mechanical construction which theretofore had been wholly unobtainable.

The attitude of the world toward the engineer corresponds to the attitude of the world of the 19th century toward the physician. He speaks a language which the laity does not know. He is to be trusted in all of his conclusions and followed explicitly and implicity. He has the responsibility of that trust. If he shall build without safety, if he shall vary from his specifications, if his product shall fail to work, he shall have weakened the trust of an entire society in his profession.

Something of this is reflected in the circumstance that the management of our new Exposition for Chicago in 1933 has been deliberately placed in the hands of engineers. The general manager is a member of your profession. About him as the heads of departments are other engineers, most of them trained in the Army or Navy of the United States. The experience of President Dawes with these engineers has been that they can be trusted to solve the technical problems of the Exposition definitively, to address themselves to the exact objects set forth, to fulfill instructions literally, to reflect the ideals for which this institution and their profession are known. Young men who are entering into such a company are sincerely to be congratulated—congratulated and warned. For it is a fact of great significance to you that if the enterprise of the Exposition had been content to deal with practitioners in your profession and with them alone it would have been foredoomed to failure.

Harvey W. Corbett is the distinguished chairman of the architectural commission of a Century of Progress and I borrow gleefully one of his sayings. "If we architects were to erect a building without you engineers it would fall down. But if you engineers were to erect a building without us architects it would have to be torn down." It is not enough that a man should know the profession of engineering. For the sake of his profession and his practice, much more for the sake of his influence and his life, he must know more than engineering. It is of that need that I would speak particularly.

Every man who has ever served on a board of directors of a modern commercial or industrial enterprise has suffered from the strange inability of engineers to express themselves. They seem to have been so intent upon learning the technique of accuracy, the qualities of materials, the stresses of construction, that they have had no time to learn how to express the teachings of their study. I do not mean that no one of you can speak good English. To assume that would be to assume an absurdity. I do mean that your profession cannot speak good English and that a general characteristic of the engineer is that he lacks the ability so to present a plan as to do justice to the merit of it. In my work I have received many reports of engineers. About half of them enabled the man most concerned, the average investor, to come to an understanding of the statement without undue difficulty or labor. What shall we say of a profession which does meager justice to only half of its commissions?

Again and again managers of great enterprises have paid for the time of engineers while they instructed them in the form of reports. The need is simple. The scientific method would impel the preparer of a report to consider the uses for which the report was designed and then adopt means and methods to meet those uses. In my own contact with corporations I have found it feasible to prepare reports so that the front page presented conspicuously the general factors which the management would most desire to know. These factors are assembled by the very process of arrangement which the average student may be expected to acquire in any adequate two year course in English, covering his last year in high school and his first year in college. Nearly always the greater part of such a report is accepted by the management without discussion and the discussion tends to center upon one or two particular phases of the report. The material ought then to be so arranged that all who participate in the conference can turn readily to that section of the report which presents the data relating to the phases which have been singled out.

Particularly I do not mean that engineering reports should be attempts at fine writing. I do mean that they should be marked by accurate choice of words as to kind of meaning and as to degree of meaning, by the use of words so that they can have only one meaning, by syntax which provides each subject with its predicate and each verb with its subject. You will agree with me that while the engineer need not be able to write brilliantly he should be able to spell brilliantly and that he should have the same ready pride in the form of a report that he has in the form of a working drawing: one is as essential to the true practice of his profession as the other.

English is related to engineering not only in the practice of the profession but in the practice of the engineer's life. The old theory of having one object and one only exploded itself in the day of Mr. Gradgrind. Crying out for facts and nothing but facts he missed the greatest fact of all, which was the fact of his own life. Literature is the great developer of life. Whoever possesses a good book possesses a faithful friend, a diverting companion, a helper over difficulty, a solace in sorrow. Literature unlocks the treasury of great minds. The engineer who misses this key may possess the technique of engineering but he will miss the technique of living.

A distinguished and successful surgeon divided the technique of living into departments of work, play, love and religion. Dr. Cabot might not quiet the questioning of philosophers with such a division but he tells us what men live by. I think you will discover as you grow in experience that it is impossible to keep any one of these four elements of your life separate from the other three. They are inextricably woven together. Pity the man who gets no play out of his work, the man who cannot apply himself to his play as he does to his work, the man whose work and play do not show forth the stimulus of love that is in life, the man whose work and play and love have not God in them.

One of the most valuable ex-

(*Continued on page* 30)

INDEX OF ADVERTISERS

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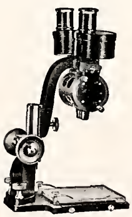
IN this machine age, industry must depend on metals for certain unvarying characteristics. The Bausch & Lomb Binocular Microscope for metallurgical analysis provides America's industrial chemists with an auxiliary analytical instrument.



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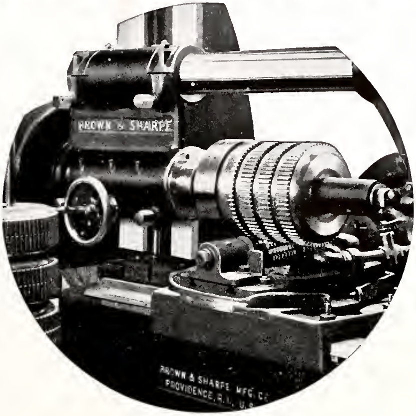

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The Well Rounded Engineer

(*Continued from page 28*)

pressions of everything fine in life is beauty and it is, if I may venture to say so, the particular expression which the engineer is unlikely to use. Watt found beauty in his construction of a parallel frame as the successful tennis player finds it in the "follow through" of a backhand stroke, as women and men of every nation find it in family love, and as the reverent children of God find it everywhere in religion.

Beauty is a natural instinct but its riches are not to be had without effort. The Gettysburg address, the "Angelus" of Millet, the unfinished symphony, the Te Deum, are all the products of a rigorous training in the technique of art—not less arduous than your training as engineers—and no hearer can comprehend their beauty in full measure who has not an intelligent understanding of the technique which underlies them. If I were a young engineer on the threshold of my life work, I should set apart a period in every day, if that were not feasible an hour or two every week, for growth through diligent attention directed to the appreciation of some one of the arts.

But if I had a son in the graduating class of Armour Institute of Technology I think on the day of his graduation I should lay the emphasis on the last of the things which Dr. Cabot says men live by. The theory is that ours is a mechanistic time, that religion is out of date. Some of our young people challenge us in their amusement with phrases like "mid-victorianism" and "unsophistication." I have every confidence that this attitude will pass from their lives as their lives progress toward maturity.

If you could set apart all the people who have an avowed faith in God on the one hand and all the people who have satisfied themselves with what the philosopher Comte called the enthronement of reason on the other hand, I think none of you would hesitate to choose the first group for your own company. It is a strange thing how it is the mothers and fathers, the folk of quiet and unpretending character, the gentler folk, who believe in God and are content to express their belief without ostentation in their lives. It is not without significance that the company of those who think that life can be reduced to the philosophy of a slide rule is constantly changing, is constantly running after new and strange gods, is constantly finding the fruit of their philosophy bitter and unpalatable.

I remind you that the baccalaureate sermon presented so brilliantly by Dr. Shannon had three texts. Perhaps you will permit me to have one and to use it as I close:

"What doth the Lord require of thee but to do justly and to love mercy and to walk humbly with thy God?"

Sun Spots and Radio

(*Continued from page 9*)

ly to the changing electrical conditions of the atmosphere through which the broadcast wave travels.

The Wolfner number was determined every clear day at the Perkins, Yerkes, Mount Wilson, Harvard, and Naval Observatories, and the resulting Wolfner curve was compared with the curve plotted from the data taken daily by Dr. Pickard. The two curves are self explanatory. Practically without exception, long distance night reception in the broadcast zone is poor when sunspots are numerous, and good when they are few. Other similar experiments have been conducted by other scientists, all with the same, unfailing, consistent results.

Inasmuch as these observations have proven so decisive, some explanation of the function of sunspots in decreasing radio reception is in order. The most plausible theory as yet propounded is that sunspots are responsible for the raising and lowering of the Kennelly-Heaviside layer.

It was first thought that the upper air could act only as an absorber of radio waves, but as early as 1902, Kennelly, an American, and Heaviside, an Englishman, independently suggested that some "reflective or refractive effect must be assumed to explain long distance communication beyond the bulge of the earth." Since then the term "Kennelly-Heaviside layer" has been used to describe the condition of the upper atmosphere under certain conditions.

The atmosphere, from fifty to five hundred miles above the surface of the earth is in a state of ionization, varying in intensity from time to time. This is due according to theoretical deductions to the electrons, emitted from the sun, constantly bombarding the earth's atmosphere at high velocity and tearing apart the positive and negative charges of the atmospheric atoms. The effect is the same as the auroral display, although to a lesser degree. The lower boundary of this ionized layer is the Kennelly-Heaviside layer.

The number of free electrons per unit of space in this layer is greater than that in the air below. The effect of increasing the "electron density" is to reduce the dielectric constant of the space, and, since the velocity of a radio wave is inversely proportional to the dielectric constant, an increase in electron density causes an increase in velocity. A ray entering a less dense medium at an oblique angle from a more dense medium will be refracted; and so the radio ray, entering the region of increased electron density, is refracted downward, toward the ground.

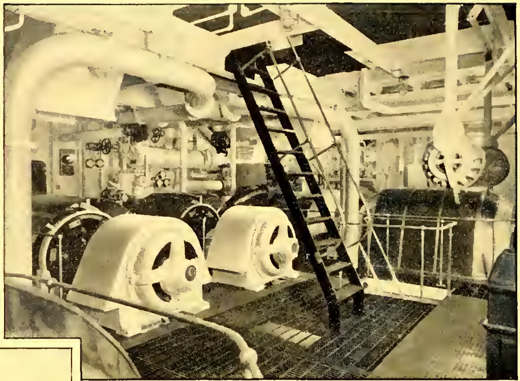
As may be clearly deduced from the diagram, the higher the Kennelly-Heaviside layer, the greater will be the distance that the wave may travel. If the sun is more active on occasion, as when large spots appear on its surface, the degree of ionization increases, producing substantially the effect of lowering the Kennelly-Heaviside layer. When the sun becomes less active, the atmosphere tends to return to its normal state of ionization, and the radio broadcasting reception tends to improve as the ionized layer lifts.

According to the theory of broadcast wave refraction, the phenomenon known as fading may be easily explained. An abrupt change in the height of the layer of ionized gases will be instrumental in causing the intensity of the incoming signal to vary.

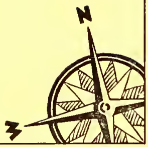
The generally prevalent belief that summer reception is always

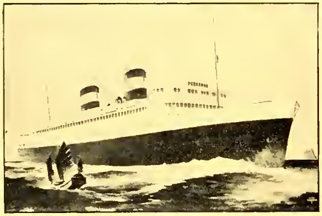
poor and winter reception is universally good is quite unfounded. As a general rule, the increased daylight of summer will be responsible for a decrease in reception, but the radio curves show that the increased solar activity gave much poorer reception in the winter months of both 1926 and 1927 than during the summer months. The excess static due to thunder storms, which are more prevalent in summer than winter, increases the noise level, and the average listener will decrease the sensitivity of his receiver that these disturbances may be lessened. Consequently, the intensity of the signal is decreased, and the listener is under the illusion that the summer is responsible for the diminution of the intensity.

The study of the relation of sunspot activity to radio reception has been of a highly theoretical nature. Only in the past six years has the effect been studied, but the unfailing coincidences of the two phenomena may permit a very definite forecast that the reception in 1934, when the sunspot quiescence is at its peak will be the best in the history of radio.

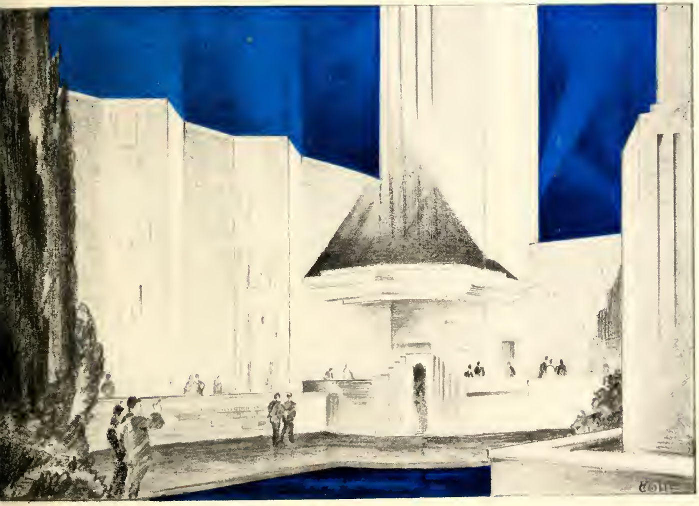


Typical engine room of a modern all-electric ship





The ARMOUR ENGINEER



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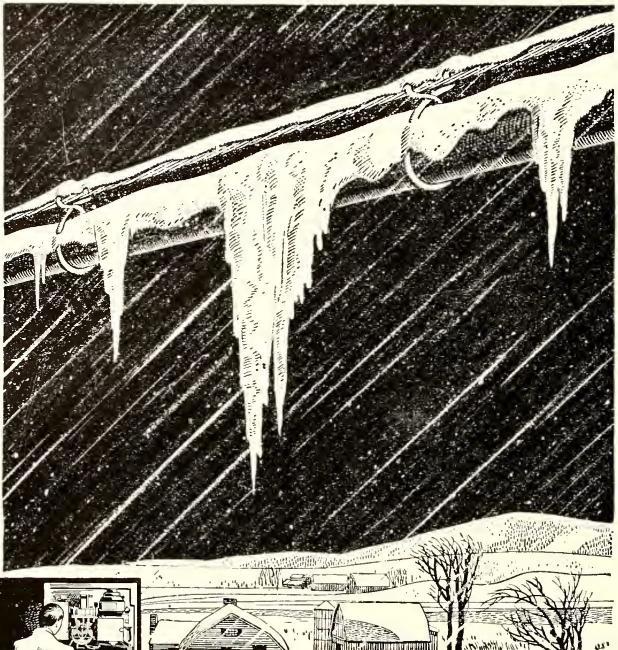

THE ARMOUR ENGINEER

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Volume XXIII January, 1932 Number 2

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Chicgao at Sunset as seen from the Lake.

The ARMOUR ENGINEER

Volume XXIII January, 1932 Number 2

Chicago's New Outer Drive Improvement

By J. M. Jacobson, '29

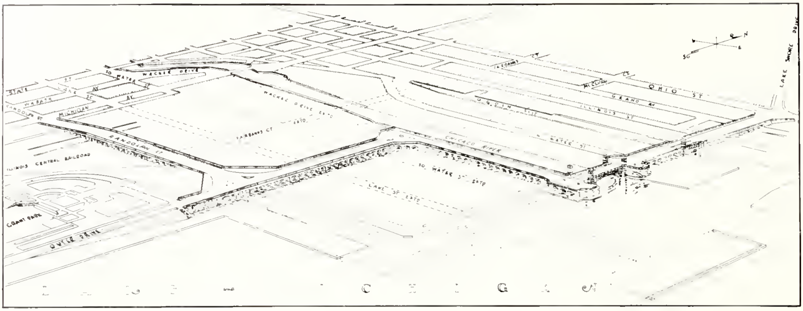
Instructor in the Department of Civil Engineering

THE outer drive improvement had its inception on October 22, 1926, when Mr. Charles H. Wacker, then chairman of the Chicago Plan Commission, appointed a special sub-committe to make a study of the possible plans for such an improvement. The need for a new river crossing to the east of Michigan Avenue had been felt for some time. The South Park Commission had spent a considerable amount of money in the development of Grant Park and the Outer Drive, which now gives the south side motorist a through, high speed route to the loop. In a similar manner, the Commissioners of Lincoln Park had constructed and improved the Michigan Boulevard—Outer Drive—Sheridan Road system from the loop to the North Side. The Chicago River forms the dividing line between the two systems, the only easy crossing being the Link bridge, already overcrowded with both automobile and truck traffic. In order to derive the full benefit from the large expenditures of both the Park Boards, it is clearly necessary that there be a connection between the South Park Boulevard system in Grant Park and the Lincoln Park System, which now ends at the Navy Pier on the North Side. The advantages of such a completion of the great lake front development, would be immediately felt both by through traffic, avoiding the crowded loop district, and by vehicles leaving and entering the loop, which would find congestion very much reduced.

The committee appointed by Mr. Wacker made a thorough investigation of a large number of alternative plans for making this connection, the results of which narrowed the selection down to seven possibilities. The complete report on the seven studies was made by the committee in May, 1927, and included the discussion of the advantages and disadvantages of each plan and the estimated cost of each. At the very outset, the possibility of a vehicular tunnel or a high fixed bridge was suggested. A careful comparison of the relative advantages of these schemes with the bascule bridge crossing was made. The chief advantage of the tunnel or high bridge is the elimination of traffic blocks due to river traffic. When the relative cost is considered, however, the bascule bridge is well ahead, the total cost being less than half of a tunnel or fixed bridge. The excessive grades required as well as the long approaches and the impossibility of future connections to Wacker Drive when extended led to the final rejection of both tunnel and high fixed bridge schemes.

Above is shown a steel cylinder ready for sinking.

The final solution was plan number two of the



Here is reproduced a plan of the Outer Drive as it will appear on completion.

seven alternatives and utilized a bascule bridge for the river crossing. Lake Shore Drive is to be extended southward from Ohio Street on a filled approach 139 ft. wide to Grand Avenue. Crossing Grand Avenue, which is depressed at this point in order to reduce the viaduct height, the boulevard extends over the tracks of the Chicago Dock and Canal Company on a steel viaduct. The North Pier Terminal Building, extending along the Michigan Canal (Odgen Slip) at this point is cut through and refaced permitting the extension of the improvement to the edge of the slip. The Michigan Canal is crossed by a single leaf bascule bridge 108 ft. wide and providing a clear channel for navigation of 70 ft. The roadway continues over a viaduct structure to the Chicago River, which is crossed by a double leaf bascule bridge. This will be the longest bridge of this type in Chicago being 264 ft. between trunnion bearings, 108 ft. wide, and providing a clear channel of 220 ft. Large plazas at each approach are incorporated in the design, arrangements being made, also, for a future lower level crossing. At the South plaza, the drive will make a right angle turn to the west, along the north bank of the river and the line of Wacker Drive. The Outer drive will then be extended Northward from Monroe Street on a fill and viaduct to make connection at the river. This extension is, up to Randolph Street, already under construction as part of the Randolph viaduct improvement over the Illinois Central tracks. The total cost is estimated at $10,000,000, which is to be divided between Lincoln and South Park Commissions.

At the present time, the improvement has been entirely completed from Ohio Street to the Michigan Canal. On the rest of the work, the pits for the bascule bridges and about 75% of the viaduct substructure between them are finished.

In the following description of the work on the improvement no attempt will be made to do more than "hit the high spots" of construction now in progress. The methods being used are, with a few exceptions common practice in Chicago. The viaducts are steel structures covered with concrete and supported on subpiers resting on solid rock. The bridges are of the usual Strauss type with the trunnion bearings supported on a cross girder, the trusses being left free of bracing to clear. This differs somewhat from the S girder support developed by the City Bridge division. The Strauss Engineering corporation, Chicago, was designer for both bridges and the viaducts now under construction or completed. The entire construction is under the general supervision of Mr. Hugh E. Young, M.A.S.C.E., who is Chief Engineer of the Chicago Plan Commission and Consulting Engineer for the Lincoln Park and South Park Commissioners. Harry Bernstein, C.E., Armour '24 is Engineer of Bridge Construction and in direct charge of the work.

Construction of Cofferdams

The cofferdams for the river and slip bridges differed somewhat in detail and method of construction. In both cases the Carnegie M-110 steel sheet interlocking pile was used. This section is of deep U form, 16″ between centers of interlocked joints and 6″ deep. In building the cofferdams for the Michigan Canal bridge pit, a set of round wood piles was driven around the outside of the proposed dam. To these a pair of 12x12 walers were spiked, outlining the outside of the cofferdams. The sheet piling was driven tightly up against this form. Clay inside the dam was then excavated with a clam shell bucket to an elevation of approximately 35.0 ft. below datum to clear the bottom set of bracing when placed. Bracing consisted of seven tiers of struts and walers. The lowest set was constructed inside the sheeting and floated. As the upper sets were built on top the weight caused the whole structure to sink. When all the timber bracing had been completed, additional weight in the form of reinforcing bars and steel punchings were placed on top until the bottom set had settled to the required elevation.

Very little diagonal cross bracing was used so that the whole dam was not very stiff in spite of the large amount of structure and considerable movement was experienced.

In comparison, the cofferdam built for the Chicago River Bridge substructure, was a simpler and lighter structure. The depth of the pit for the river bridge is about six feet less than for the Ogden Slip crossing so that the water pressure on the dam is considerably less. The method of construction was also somewhat simpler. The lowest tier of bracing was built and floated into position. This was then used as a form for the sheet piling which was driven

around it to form the dam. The next tier was then built on top and the whole sunk in the same manner as for the slip bridge coffer dam. A 3″ clearance was allowed between the sheeting and the bracing so that when the water was pumped out the joints tightened. Leaks were sealed by dumping fine cinders around the outside. The inflowing water draws them inside the openings and gives a fairly water tight structure. The pit must be kept dry, however, by more or less continuous pumping, a set of drainage ditches, and a sump being provided for this purpose.

Because of the large amount of cross bracing used on this dam (3x12 planking) the structure was exceptionally stiff and in spite of the fact that on both sides of the river the cofferdams were well out in the water, very little weaving resulted. The advantage of this type of bracing was clearly shown when the large 120′ derrick boom on the North side of the river buckled and broke the top two sets of bracing struts right through the center of the dam. Though the side walers bent slightly, serious damage was averted because of the rigidity of the whole structure.

Construction of Subpiers

The so called "Chicago Open Well" method was used. After the cofferdams had been pumped dry, the engineering force laid out the well centers by tracks and marks on the bracing timbers. Dropping a plumb bob from the intersection of two chalk lines between these marks, the center of the well was located and excavation begun. From four to six diggers are used in a well depending on the size. (8 to 12 ft. in diameter). When the excavation reaches a depth of four or five feet a set of tongue and groove maple lagging is assembled in the hole, the inside diameter being that of the finished well. The lagging consists of a set of finished planks two or three inches thick with beveled edges and five feet four inches long. These are set vertically in the well and interlocked, being held in place by a set of steel rings of the proper diameter. For the small wells these rings consist of two semi-circular arcs with the ends bent and bolted together. Formerly, bent steel bars were used but the more recent type is made of bent structural channels with lugs welded on the ends. For the larger wells the arcs are less than a semi-circle, three or four being used in the circumference depending on the diameter of the subpier. Both lagging and rings are left in place when the wells are concreted.

Clay is removed from the well by means of large metal buckets operated at the end of a rope from a hoist set on a tripod at the top. For the larger wells two buckets are used. The material was dumped through short wooden chutes either directly into the river or into large roughly made wooden boxes in the coffer dam from which it was removed from time to time with an orange peel bucket. Because of the great depth of the excavation, the temperature is very low at the bottom and in mid-August when the thermometer read well over 90° at the top it was necessary to wear heavy coats in the well. Besides this, the cold air condensed the moisture near the top so the men digging at the bottom are subjected to a light, but continuous rain at all times.

When rock is reached the caisson is belled out slightly and the bottom cleaned up and leveled off. Two or more small test holes about five feet deep are drilled to make sure the rock is sound and without seams. Vertical seams filled with clay or soft rock appeared in a few of the wells but since the ledges were considered safe and since there were no horizontal seams they were called satisfactory. When poor rock was found it was excavated until the drilling indicated that satisfactory conditions existed. The rock elevation varied from 85 to 93 feet below datum, the surface being in fair condition. The general slope at the site appeared to be downward toward the North East with a fault line parallel to the South bank of the river. So little of the rock is uncovered, however, it is hard to make general conclusions.

All wells were concreted up to the bottom of the pit floor at ele-

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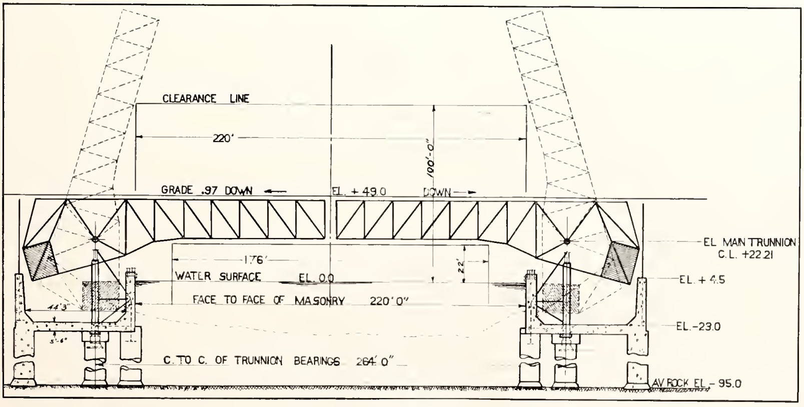

Above is the double-leaf bascule bridge to cross the Chicago River.

Safeguarding The Conflagration Hazard

By W. M. Trauten, '32

Student in the Department of Fire Protection Engineering

THE tremendous loss of life and property in the United States within the last seventy-five years due to sweeping conflagrations has made the study of the conflagration hazard an important item in Fire Protection Engineering. The danger of a sweeping fire exists in every town and city in the United States and to a much larger degree in those closely built up sections containing a large number of combustible buildings.

Conflagration hazard has been described as the inherent but dormant capacity of neighboring structures to cause a general fire in all such structures as are mutually exposed at the time of the fire. In an insurance sense a conflagration is a single fire involving two or more buildings. The hazard is not necessarily confined to mutually exposed buildings but can and often does involve widely separated units.

Among the most disastrous conflagrations in the United States were the Chicago fire in 1871 resulting in a loss of about \$168,000,000 and the San Francisco disaster in 1906 in which the total loss of property amounted to \$350,000,000. There was also a \$75,000,000 fire in Boston in 1872 and a \$50,000,000 loss in Baltimore in 1904. The San Francisco disaster was the largest in our history, destroying the greatest amount of property and having the largest monetary loss. Fire records indicate that we experience a serious fire destroying property to the extent of \$5,000,000 or more at an average of every two years. This alone stresses the importance of conflagration protection since the habits of the American people are not easily broken and the probability of such losses is diminished but slightly from year to year.

Although high pressure water systems and efficient fire departments are of service in preventing the spread of large fires, they prove to be weak instruments in the checking of an onrushing conflagration. In large cities a fire is often above the reach of the fire department equipment and it does not stop until it has "burned itself out," a condition existing when no combustible matter is within striking distance of the fire. Whether or not the conflagration hazard can be eliminated is doubtful. In an absolute sense it cannot, but its danger can be cut down to a minimum in a practical manner and without necessarily employing drastic measures.

Skeleton of Curtis Candy Co. Building after the complete destruction of the interior.

Some of the improvements suggested are: the raising of building standards by using only fire resitive construction; the elimination of wood and combustible materials; the removal of hazardous processes in congested sections; and finally the use of only solid brick walls for severe exposures and to properly protect all exterior windows, doors, and other wall openings.

The construction of our closely built up sections can be compared to the structure of a huge honeycomb. In the honeycomb, however the walls are continuous and each individual cell is isolated while the isolation of fire hazards is not absolute. If it was possible to very nearly approximate this separation, thus making it exceedingly difficult for a fire to leave one building and equally as difficult for it to enter another, we would have a condition in which a conflagration would be very improbable. Correct and adequate protection of all exterior masonry wall openings would be as near to this condition as it is possible to attain without seriously altering structural conditions. The construction methods and protection devices now available are elaborate and sufficient enough to obtain desired conditions, providing they are applied intelligently and the devices installed properly.

A single fire may spread and assume the dignity of a conflagration in any of three physical ways: conduction, convection, and radiation. Conduction of heat occurs only in adjacent buildings or fine divisions and is rarely effective in the spread of fires through masonry walls except when such walls have unprotected openings since it

Above is shown the ruins left in the wake of the Curtis Candy Co. fire in Chicago.

takes several hours for a standard brick wall to be heated sufficiently to cause failure. Convection presents a most dangerous means of conflagration spread. It is seldom that hot brands of considerable size are not seen rising high into the air above a large fire due to the upward rush of heated air surrounding the fire. These brands are large enough to crash through skylights and start other fires. Another convection phenomena is the hot blast feature of extremely hot gases traveling in the direction of the wind. Such gases contain considerable carbon monoxide and on reaching an atmosphere containing oxygen, their own temperature is high enough to cause an explosion which often takes place in far removed buildings.

Radiation is a form of wave motion traveling equally in all directions through gases, liquids and transparent solids. Radiated heat is known to have been effective at distances as great as 500 feet away. Radiated heat presents the greatest problem in window protection.

From the conflagration viewpoint the inherent weakness in building construction lies in the protection of windows and other exterior wall openings. This creates the exposure hazard which is the weakest link in the otherwise strong chain of modern fire protection engineering. Proof to this statement is inferred in the reports of the fires in Baltimore in 1904 and in San Francisco in 1906. In both of these fires buildings having windows of wire glass, metal frames and sash, and provided with shutters stood up among the ruins of surrounding unprotected buildings.

The efficiency of an exterior masonry wall under any fire test will vary inversely as the number and size of openings in that wall. The solid brick wall of sufficient thickness and proper construction is the best fire stop but such a wall is practical only for party walls or those immediately adjacent to other buildings. The number and size of windows in a wall is determined by the occupancy of a building. Because a large amount of light is required in an office building, a large number of windows is essential. This creates a condition which makes such a building powerless to resist the fierce attack of fire from a neighboring building unless all the windows are amply protected. The fire in the Home Life Insurance building in New York in 1898 offers an excellent illustration of such a condition. This building was of fire resistive construction, having steel framework, properly protected, and with stone panels. A fire broke out in a five story ordinary wooden floor and beam constructed building occupied as a clothing store which was located immediately south of the fifteen story Home building. The fire departments kept the blaze localized for about one hour by means of water streams from standpipe connections and pumpers despite the naked exposure to the Home building. Before long the roof of the burning building caved in and the court of the large building, acting as a huge chimney, afforded a means for the flames and hot gases to attack the unprotected openings and in a short time the windows melted and their sash burned, allowing the fire to spread to the interior of the Home building to destroy all the contents and furnishings. As is the case in most cities, the water pressure was not great enough to permit the fire departments to do any good above the eighth floor; and their efficiency below this point was not high due to their inability to face the extreme heat.

Barring danger done to marble and terra cotta finishes, window protection of almost any kind would have eliminated any serious loss to this office building. Proper protection in this instance would have afforded a screen behind which the firemen could work. There are many other cases of this character—including the more recent fire involving the Burlington office building in Chicago in 1922, which is almost parallel to the illustration cited.

If all mercantile and other highly congested sections were built up of buildings of fire resistive construction, there would be less need for window protection because fires do not spread easily in this type of building. However, such is not the case as we invariably have the mixture of the poorer and better classes of buildings. Assuming though that

(*Continued on page* 54)

Another view of the fire ruins showing the effect of the great heat on the neighboring building.

The Power Shovel

By Harold Monger, '33

Student in the Department of Mechanical Engineering

WHERE, in all the many activities of modern industry which the general public gets a chance to see, can one find a sight more fascinating than a power shovel in operation? Look over the crowd that will gather along the rail at the side of an excavating job and you will find everyone from housewives to stenographers and from successful business men to grammar school boys.

They are thrilled by the roaring monster who knows no immovable objects and whose irresistible force seems to be unlimited. A power shovel may have the strength of twenty elephants and a dexterity which nearly approaches that of the human body itself. Its usefulness lies in the remarkable way in which it responds to the will of the operator: as though the flimsy levers which he pulls and pushes were but the ends of sensitive nerves that transmit his wishes to the strong boom and its fast-acting dipper.

Before going further it might be well to explain that in digging there are three operations. Crowding is the force acting along the dipper handle. It acts as a means for pushing down under the surface. Hoisting is the force exerted in lifting the shovel upwards and is accomplished with the aid of cables and sheaves. The swing mechanism usually functions to bring the shovel over, after the dig, to the point at which it releases its load into a truck. Sometimes on a side cut the operator uses the swing like the crowd to exert a force, driving the bucket into the ground.

The swing is also used to "sweep" the loose material left by the digging over in front of the shovel where the operator then proceeds to scoop it up and leave a clean surface.

To accomplish this desired flexibility, has been the task of a great industry for the past seventy-five years. The shovel is a development which arose from river dredging and was first applied to excavation on land in the year 1880. Steam power was used exclusively. It was driven by a single engine. The crowd and hoist received their power by means of a chain car carried on grooved sheaves. This device was easily worn out and was noisy.

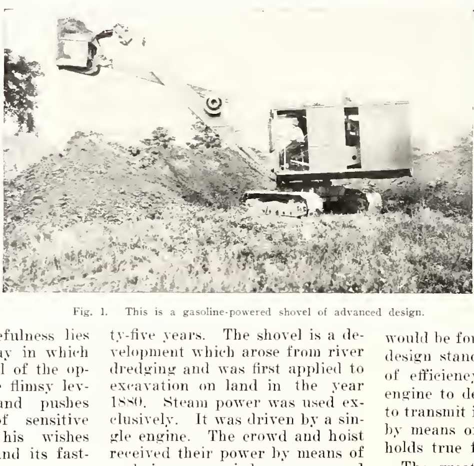

Fig. 1. This is a gasoline-powered shovel of advanced design.

Later as steam power became better understood and the demands on shovels became greater, they were designed with separate engines for each of these duties. This system is still used today although steam does not meet with the popular approval that is given other modes of power.

The earliest shovels were installed on rails; crawler type trucks, with which we are now familiar, came as a later innovation.

When the advantages of gasoline, Diesel, and electric motors were realized as methods for power development they were all applied to "power" the shovel. (The expression "power shovel" then became proper in place of "steam shovel.")

Steam had the advantage of being applicable to smaller units without loss in efficiency per unit. This makes it possible to divide the power into separate engines for direct connection to each of the mechanisms controlling the three operations: hoist, crowd, and swing.

This cannot be done in the case of the gasoline engine. If it takes, for example, ninety horsepower to do the work of the shovel and it is run with a gasoline engine it would be found desirable from the design standpoint as well as that of efficiency to install only one engine to develop full power and to transmit it to the desired points by means of clutches. The same holds true for Diesel engines.

The great disadvantage of the steam shovel lies in the necessity of having available the right kind of fuel and water for efficient operation. Also it is not as mobile because the boiler must be verticle and this increases the clearance necessary for the shovel.

The story is told of a Chicago contractor who had a job on the outskirts of the city in which a steam shovel was to be used. He drove it up on the trailer platform (full steam had to be developed for this) and started out from

(*Continued on page 60*)

Arc-Welding In Steel Construction

By James S. McCall, '32

Students In The Department Of Mechanical Engineering.

THE old order changeth and giveth place to the new—but not without a struggle. The fact is evident that human nature is averse to every change in its accustomed mode of living. Each great invention and scientific development has met with opposition. But in the end these evolutionary steps have always prospered and have proved their true worth by directly or indirectly raising the standard of living and by lightening the burdens of the human race.

One of the latest of these developments is the use of electric arc welding in the structural steel industry, both to replace riveting and to broaden the scope of its usefulness. This comparatively new art brings with it many advantages which bid fair to effect its universal adoption as a means of promoting efficiency, reliability, and economy in the fabrication of steel structures of all kinds.

The method of arc welding is the latest of a series of steps in the history of structural methods which have come about within the last fifty years, a brief outline of which follows.

Between 1880 and 1890 iron and steel truss members were commonly connected together by means of pin joints, each joint of the truss having one cylindical pin of sufficient diameter to carry the shearing and compressive stresses present. For a long time it was thought that, because only one round pin was used, thereby providing a hinging action, no secondary stresses could be set up. However, by the year 1890 it had been proved that the friction between pin and members was so great that large secondary stresses existed which could not be ignored. These introduced an uncertainty into the design which was very undesirable.

It was about this time, 1890, that riveted joints came into their own. The two types are in use to this day, but riveted joints are more prevalent. By 1900 the riveted connection had definitely taken its place as a standard accepted method of construction.

At the beginning of this century reinforced concrete construction put in its appearance. With its use came many failures due to ignorance of proper design and construction methods, but in time confidence in the method grew. By 1910 large reinforced concrete buildings were being successfully erected, and this process had taken its place along with pins and rivets as a standard method. Spirally reinforced columns and flat slabs were perfected, and contributed their share to the advancement of building construction methods.

So it went; all of these methods worked together harmoniously, making possible larger and finer buildings. Yet, the men who developed these building tools can well remember the difficulty with which building codes were modified to permit their use. In many cities reinforced concrete structures were built several years before their building codes were modified to admit the new type. This was made possible by special permits granted to those progressive builders who saw the advantages to be gained by insisting on the use of the new methods.

And now we have the latest method, arc welding, which has met with the same difficulties encountered by the other types of construction. Builders have feared it. They have been frightened by the relative intangibility of a welded joint compared with a riveted one. The human element in welding, it would appear, is more important than it is in riveting. To obviate the human element, nevertheless, especially on important buildings and bridges, welders are not employed merely upon

Above is shown the arc-welded frame of the new Dupont 14-story office building in Wilmington, Del.

their claims of experience, but are required to execute sample welds to prove their ability. Only one hundred and thirteen cities in the United States have revised their building codes to include arc welding. A great many of these are California municipalities which have all adopted the uniform Building Code of the Pacific Coast Building Officials' Conference. Other cities have made it possible to use welding as a building tool because they have invested discretionary power in their building commissioner, who may acordingly allow its use under proper supervision, if he sees fit.

Other cities have been studying the subject but have accomplished little of a practical nature. One of the reasons for this is that the commissioners find it difficult to select a suitable method of qualifying welders, and to formulate a suitable code. As far as the qualification of welders is concerned, it seems unnecessary for governments to exercise any direct control over them when it is much more convenient simply to require the welding contractor to present satisfactory evidence that his welders are properly qualified. Movements to bring about adoption of uniform codes are under way in several sections of the country. The code of the American Welding Society is the standard upon which other codes have been based; consequently, there is a close agreement between all of the codes thus far adopted. The revision of codes and the preparation of specifications for welded buildings are highly important matters which every progressive city should immediately investigate. The reaction to the suggested use of welding in connection with structural steel fabrication is now much the same as the attitude of engineers when rolled steel plates and shapes were first placed on the market. Education and experience, however, gradually eliminated doubting minds, although it took some years to overcome all prejudice. The antipathy toward welding is being more rapidly dispelled, perhaps because more intensive research work has been done, and the economies of the process are more apparent and more broadly published.

The technique of welding is no longer a deterrent. Trained and reliable welders are available for all kinds of operations. The application of welding in many lines of manufacture has been widespread. Yet, in structural work the knowledge of proper details and applications is still incomplete; and it behooves the structural engineer to give proper attention to this new art and to learn its proper and economical applications.

Electric arc welding is far from being a new process. Prior to the World War, however, it had assumed little importance. Between 1914 and 1918 the heavy production demands upon industry made arc welding very important, but mainly as a repair tool on broken machine parts. Even today many manufacturers who use welding employ it only for repairing broken parts, but there are many more who find it invaluable as a tool for straight production work.

Although arc welding of structural steel was first demonstrated as early as 1877, and small welded steel structures began to appear in 1915, it is only within the last four or five years that the process has been extensively used.

The meaning of the term "welding" is not generally known. The process consists of bringing two pieces of metal to their fusion point, allowing them to mix, and then solidifying them as a more or less homogeneous mass. There are many variations. Sometimes more metal is added. Fluxes may be used to aid the flow of metal and to prevent surface oxidation by the surrounding air. These extra maetrials are usually supplied in the form of thin round rods of the proper composition. These are called filler rods or merely welding rods.

Fusion welding or antogeneous welding may be done by a gas flame oxy-acetylene, by the thermit process or by the electric arc. The first two methods, however, do not come within the scope of this article.

Electric welding may be classified into two general methods; (1) resistance welding, and (2) arc welding.

In resistance welding heat is produced sufficient to fuse the two pieces of metal by the passage of a low voltage, high amperage current through their junction.

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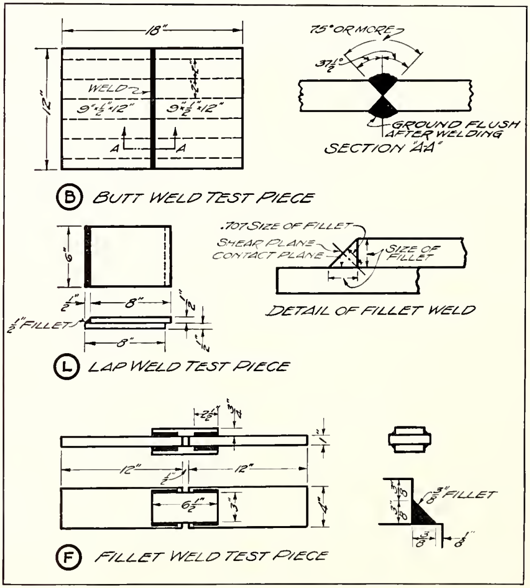

Qualification Tests for Arc-Welders.

The Canal Era In Pennsylvania

By Robert S. Mayo, C. E., '23

Erection Superintendent, Blaw-Knox Co., Blaw-Knox, Penn.

THE eye of the traveler will see from the car window the windings of an old embankment, fast being erroded by rain and plow, which marks the contour of some once busy waterway; or the remains of a rock-crib dam, which freshet and ice have long ago destroyed, with a sturdy masonry lock still beside it, which once slack-watered some river. But few people, even engineers, realize the extent of artificial waterways during the canal era of the United States.

Piers of an old wooden Acqueduct.

In 1825, after seven years of hard work and after spending seven and one half million dollars, New York opened the Erie Canal. It was the first major canal project in this hemisphere, and it was successful from the start. Three hundred and sixty-three miles of shallow ditch through howling wilderness, but it served to make New York City the leading commercial city of the Atlantic seaboard, and diverted much of the trade away from her competitors. Immediately her rivals set projects underway to regain their lost commerce with the Ohio Valley. These resulted in the Pennsylvania Canal from Philadelphia to Pittsburgh, the Potomac Canal from Washington to Cumberland, Md., and the James River Canal from Richmond to Clifton Forge. Each of these canals followed one of the four main stage-coach routes, and each one was later paralleled by a prosperous railroad.

Conditions were much more favorable for canal building on the west side of the Alleghenies. Ohio entered the race with such vigor that in seven years she possessed 400 miles, and in twenty, 1001. Indiana made several false starts, but ended with a main line canal of 458 miles, and a debt of 9½ million on her scanty population. Illinois built the 100 miles of much needed connection between Lake Michigan and the Illinois River in 1846. It was opened so late in the era that its brisk prosperity was soon strangled by the railroads.

In 1835, ten years after the completion of the Erie Canal, the nation possessed 2617 miles of canal. Forty-five years later the census report gave the total mileage of all canals in the United States as 4468, costing $214,000,000. Three-fourths of this mileage was in New York, Pennsylvania, Ohio and Indiana . At that time (1880) 2000 miles had already been abandoned. Today, except for the New York Barge Canal, (enlarged at a cost of 100 million) and a few coast-wise channels, all have been abandoned.

The Main Line of the Pennsylvania Public Works was unquestionably the most daring and difficult engineering feat of the early 19th century. It was a greater undertaking to the poor and sparsely settled state than the Panama Canal was to the nation eighty years later. Engineers were imported from Europe or borrowed from the Army. Excavating machinery was non-existent, steam locomotion was still experimental. There was much agitation in favor of the newfangled railroad (horse-drawn) because Pennsylvania topography was not as favorable to canals as was that of New York. Compromise between the adherents of these two methods of transportation resulted in the first 86 miles, across the rocky uplands between Philadelphia and the Susquehann River, being railroad.

This line was opened to the public in 1834. Steam locomotives were adopted gradually; it was ten years before horses were entirely excluded from the system. The state of Pennsylvania owned the track and operated the locomotives, but all cars, warehouses and sidings belonged to individuals. The state collected a 'ton-mile' toll on the rails as they did on the canal.

The canal started at Columbia and followed the wide and turbulent Susquehanna to above Harrisburg, where it crossed a mile long wooden bridge. Thence it followed the windings of the Juniata through four ranges of mountains to Hollidaysburg. This was 172 miles from Columbia and 700 feet above it. (The rise and fall in 363 miles of the Erie was but 500 ft.) This elevation necessitated 108 locks with an average lift of feet.

(*Continued on page 62*)

ENGINEERING NEWS

Automatic Pump Unloader Aids Synchronous Motor Drive

By equipping a triplex reciprocating pump with an automatic unloader which works in conjunction with the motor control, to unload the pump automatically, it was recently made possible to drive the pump with a synchronous motor. Without this device it was necessary to unload the pump manually.

It was also loaded and synchronized manually when the motor was up to speed because it was not feasible to provide the motor with full-load starting torque. With the automatic unloader, working in conjunction with the frequency responsive control, the entire starting operation is made automatic, it being necessary only to push the starting button.

A magnetic solenoid controls the rotation of a camshaft for holding open the suction valves. The lifting cams are operated by a rod connected eccentrically to the pump crankshaft. When the solenoid is de-energized the cams are so rotated that the suction valves are held open during the normal pumping stroke. When the solenoid is energized the cams are rotated away from the suction valve lifts and stopped to permit regular pump operation.

By use of this unloader for a synchronous motor-driven reciprocating pump the following advantages are ganied: (1) Permits continuous operation without attention, regardless of momentary power dips which would otherwise shut down the pump; (2) simplifies starting; (3) makes possible automatic start and stop operation to maintain the desired liquid lead on pressure in the tank.

World's Longest Bridge Span

The longest suspension bridge in the world has recently been opened to traffic acros the Hudson River between New York and New Jersey. The George Washington bridge has a 3500-foot span, a floor 120 feet wide, and a height of 250 feet above the river, suspended by four cables strung between towers 635 feet high. Eight traffic lanes are provided for automobiles and trucks to accommodate at least thirty million vehicles annually.

Courtesy—Public Works

Above are some views of the Washington Bridge across the Hudson.

A few of the outstanding construction features are of interest. The suspension towers are supported on concrete piers 100 feet square which rest on bed rock 80 feet below the river surface. To accomplish their erection, necessitated the deepest open coffer dams ever used. The four suspension cables contain over 100,000 miles of galvanized wire and each has a strength exceeding 220,000 pounds per square inch. The cable diameter is 36 inches,—a dainty necklace! They were spun throughout the storms of last winter without any interruptions, due to the use of temporary bridges which themselves cost $700,000. The total cost of the bridge was $75,000,000. It has been estimated that the structure will pay for itself in twenty-two years through the medium of moderate tolls to be paid by each traversing vehicle.

Steam Now Used For the Cooling of Trains

A new innovation contributing to the health and comfort of the traveling public is the use of cooled and conditioned air in railway passenger coaches. The process consists in using exhaust steam from the engine as a source of refrigerating energy, and water as the refrigerating medium.

A tank partially filled with water is located at one end of the car. Steam is passed over an opening in the tank and by throttling action a vacuum is created within the vessel. Due to the lowered pressure, the water boils at a temperature of fifty degrees. The vapor formed is drawn out by suction and since it carries a considerable portion of heat along with it, the remaining water is cooled to forty degrees. This cold water is then circulated through coils in the roof of the car, and air is drawn over them to be cooled and dehumidified. Finally, the conditioned air is circulated through ducts in the car and the water is returned to the storage tank together with the condensate.

This system allows for a complete change of air in the car every minute, a total quantity of 2000 cubic feet. In winter, the air may be heated by passing it over the same coils which carry steam or hot water.

Electrolytic Process for Making Metal Patterns.

Electrolytic processes are used extensively in industry for plating one metal with another in order to improve the appearance or increase the wearing qualities. Little is known, however, of the possibilities of depositing metals on other materials by such processes.

A most unusual application of this sort has been developed by a prominent electro-chemical company. Metal patterns are produced by depositing copper electrolytically in plaster molds until a shell of substantial thickness has been obtained. Shells of this type are used for the molding surfaces of patterns and cores.

Either wooden or metal patterns can be used. If wood is used, it should be either mahogany, cherry, black walnut, or some other hard wood that will not absorb moisture readily.

The molds are made from a composite material, resembling plaster-of-paris, in wooden forms. The plaster composition is poured on the working pattern, which is laid on a surface plate within the wooden form. After these molds have solidified, the wooden forms are removed and the molds are thoroughly dried in a gas-heated oven. They are next made water-proof and are also made resistent to the solution of the electrolytic bath, except in the mold cavities. The plaster molds are now immersed in the electrolytic bath and remain there for a period, on an average of four days.

When the molds are taken from the bath, the plaster is broken in pieces to release the copper shell. In order to give backing to the shells, they are filled with a non-shrinking white metal. Before this white metal is poured, brass inserts are placed in the shell to provide a satisfactory means of attaching the pattern to plates for use in the molding machines. There is some expansion of the copper when the hot metal is poured in the shell, but in cooling, the shell contracts to its original dimensions.

After the white metal has cooled, the parting-line surfaces of split patterns are milled and then machined.

Powerful Light Aids Air Maneuvers.

An innovation in aviation accomplishments was demonstrated recently by Captain Eaton, commandant of Rodgers Field when tiss Bombing plane with a tremendously powerful searchlight mounted on his ship and set off a flare located on the top of the he flew over Pittsburgh in a Cur- William Penn Hotel.

The event, which demonstrated a new development in aviation and, at the same time, how mechanical action may be controlled by means of a light beam, was enacted as one of the features of the convention of the Illuminating Engineers Society.

Courtesy—Westinghouse Electric Co.
This is the New Compact Power Light.

It is the world's smallest searchlight and yet one of the most powerful. Because it is so light and small and since it may be operated from a battery, it becomes possible to mount it in an airplane, thus opening up new fields for aerial observation.

To demonstrate the possibilities which exist for this unit in aerial service when associated with light sensitive tubes, sometimes termed "electric eyes," Captain Eaton circled the city, then trained his aerial searchlight on the top of the hotel, where a photo electric cell had been located.

The instant the searchlight's beam hit the photo electric cell, it actuated a mechanism setting off a powerful flare, thus demonstrating the feasibility of producing mechanical action of any kind by means of a beam of light. According to Captain Eaton, the new type searchlight opens the way for some interesting developments in nightly aerial maneuvers.

Developments of a New Synthetic Rubber.

Production of synthetic rubber by the repeated polymerization of acetylene has been developed to a commercial success by one of the large chemical companies. A special plant is being erected to manufacture the new material.

The trade name "Duprene" has been applied to the synthetic rubber, chloroprene being one of the intermediate substances produced during its manufacture.

Synthesis of the material is being accomplished by the addition of hydrochloric acid to monovinyl acetylene, which is first produced by the catalytic condensation or polymerization of acetylene. The final polymerization is carefully controlled to determine exactly the properties of the final product.

Chloroprene polymerizes spontaneously at a great velocity to produce a rubber similar to natural rubber which is vulcanized with sulphur. It is not necessary to add sulphur to the synthetic product because it has all the properties of the vulcanized natural material.

Stopping the polymerization at a point to give a rubber similar to unvulcanized natural rubber has also been developed. This material, according to authorities, can be mixed with fillers, diluents, coloring matter, etc., and then vulcanized by heating alone at 110 to 130 degrees Centigrade. Duprene is more dense than natural rubber, more resistent to water penetration or absorption, less permeable to many gases, is swelled less by petroleum and other solvents, and resists attack by ozone and other chemicals more effectively than the natural product.

Although the source of the acetylene for polymerization was not disclosed the relationship between synthetic rubber and petroleum and natural gas hydrocarbons is close. Acetylene occurs in cracking still gases, and may be produced under controlled conditions by pyralitic decomposition of ethane and higher natural gas hydrocarbons. Thus synthetic rubber may well be made from natural gas in the future.

THE ARMOUR ENGINEER

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Make The Armour Engineer the best technical college publication in the country.

It ought not to be the leading object of anyone to become an eminent physician, mathematician, or poet, but to render himself happy as an individual, and an agreeable, a respectable, and a useful member of society.

—DONALD STEWARD.

MUCH HAS BEEN SAID REgarding man's progress in science and in the art of living. The advance made since the fifties has been tremendous, in both social and economic phases. Yet all this progress is due in the main part to the technical developments brought about by the work of the engineer and the scientist. Economic development depends upon man's ability to produce, to transport, and to consume. All three of these factors were brought to their present state by our predecessors. Social development follows closely upon economic development, so indirectly, at least, the engineer was responsible for the improvement of man's social life.

We have been passing through a trying period of readjustment in our economic state. The engineer's handiwork has made possible new methods of production, and by the development of new materials and new articles, he has reduced materially the demand for certain other products. This has made necessary a drastic readjustment of labor. Some denounce science and technical progress for the temporary hardships that are incurred due to their functioning, but a careful consideration of all the factors involved will show them the fallacy of their position.

The world will and must ever advance, and the pace will continually be positively accelerated. If the engineers of the past, with their limited resources and their lack of data and scientific background, could accomplish what they have, what will the technical men of today achieve with the tools and resources of the present?

TO MANY OF US, THE task of finding a position will soon be of primary importance. We should find interesting the results of a survey of 1931 graduates made by Eta Kappa Nu, honorary electrical engineering fraternity.

It was found that, just previous to graduation, fifty per cent of the men had positions, thirty-five per cent did not, and about fifteen per cent expected to take postgraduate work. The average of the starting salaries was reported as \$1500, very much the same as it has been for a number of years. However, from the reports, competition is very keen and positions are scarce; the employers who are looking for men have been in a position to select, rather than compete for, the outstanding material. The outlook is a de-

pressing one, but we may as well be aware of it.

The situation calls for some serious thought on our part as to ways and means of "busting in." It's going to be more than a matter of filling out an application blank.

FROM AN EDUCATIONAL standpoint two salient features are recognized as being essential to a well qualified engineer. First, he must get a complete and thorough ground scientific training in school and second, he must get a certain amount of practice in applying what he has learned to practical everyday problems. These two facts are brought out more strongly in a recent address given by Dr. W. E. Wickenden, president of the Case School of Applied Science. We quote Dr. Wickenden in part.

"Wherever surgery develops a new technique of removing tonsils or splicing bones, there is always a clinic at hand where the practitioner can spend a few days mastering the latest advance in the art. These intensive clinic schools rank among the most important units in medical education.

"The engineer is not so well provided for as the surgeon. He receives a solid scientific grounding in school, then goes out to master the art of application in practice. If he has an unusually able boss or joins the staff of a large and progressive company he may be as well taught on the practical side as his college has done on the scientific side. In most cases he is left largely to his own devices."

GENERAL REES, OF THE American Telephone and Telegraph Company, furnished the student body with some very interesting and useful data in his talk at an Armour assembly on November 16, 1931. He showed conclusively, that in his experience, the young engineer's future success varies directly as his degree of extra-curricular activity in school, other things being equal, and his scholarship being of average grade.

This statement does not mean that the "big activity man" is going to succeed in business simply because of his participation in non-scholastic activities. The truth is that his ability to forge ahead in other lines is a clear demonstration of his possession of that extra something which raises the individual above the average run of young college men. He must have an extra ability, whether it be shown in literary work and journalism, or in his possession of a slightly better physique and brain and muscle co-ordination than his fellow student. The leader gains that status through a possession of certain qualities; it is these qualities which are important, and which are such a great factor in advancing him in his chosen career.

Certain men are not born better able to express their ideas, or with a more forceful character than their fellows. These abilities must be developed and they must be fostered in the individual's youth. That is the period when one can quickly adapt himself, and can easily learn and improve. Thus we can see how extra-curricular activities are of prime importance in aiding the student to develop some lacking element in his makeup.

The student who is eager for his own advancement, will realize his deficiencies, and seek to counteract them by work and experience in that particular field. The degree to which he succeeds depends upon himself.

Inability of expression can be corrected by work on the school publications although it is not necessary that one advance to an editorship. A frail constitution can be built up marvelously by work with an interclass or school team, although one need not rise to a varsity captaincy.

> THE OLD PIONEER
>
> *A dirge for the brave old pioneer!*
> *His pilgrimage is done;*
> *He hunts no more the grizzly bear*
> *About the setting sun.*
> *Weary at last of chase and life,*
> *He laid him here to rest,*
> *Nor recks he now that sport or strife*
> *Would tempt him further west.*
> *A dirge for the brave old pioneer!*
> *The patriarch of his tribe!*
> *He sleeps—no pompous pile marks where,*
> *No lines his deeds describe.*
> *They raised no stone above him here,*
> *Nor carved his deathless name—*
> *An empire in his sepulchre,*
> *His epitaph is Fame.*
>
> —*Theodore O'Hara.*

THE STERN ECONOMIC conditions of the last two years have resulted in the almost complete cessation of immigration into this country, and in some instances, have reversed the flow of humanity. American labor, coping with a serious job shortage, has rightly demanded that the gates of entrance into the United States be closed, and that all the legal restrictions existent be brought fully to bear to ward off the ever-increasing demands of Europe and Asia for relief through the outpouring of their excess humanity into the American labor market.

Our immigration authorities have reduced the quotas down to the minimum, and have held great numbers away by increased vigilence in enforcement of that section of the law which states that the immigrant must show reasonable certainty of not becoming a public charge.

The merciless battle for work has caused many of the more recent arrivals to seek a livelihood by returning to their native lands. Especially is this true of those elements which make up the great mass of industries' unskilled labor.

A recent article on this topic states that our Mexican population alone is being reduced 100,000 annually. This vast number is returning across the Rio Grande to seek sustenance in their native land. They prospered in the United States during the boom, in the steelmills of Chicagoland, in the beet-fields of Colorado, and in the tire and accessory plants of Ohio. When the competition for jobs became keen, these Mexicans failed.

La Prensa, the Spanish language newspaper, states that half the able-bodied Mexicans in the Chicago metropolitan area have been jobless for more than a year, and that great numbers are returning south of the Rio Grande.

In returning to their native land, these people are bringing an acquaintance with a higher living standard than is common in Mexico. This can only serve to a good purpose in its effect on Mexico's abvance.

College Notes

— A. S. M. E. —

Mr. John Maloney, assistant director of The Museum of Science and Industry, addressed the society October 31. He showed by means of slides, some of the exhibits which have been placed in the museum. The purpose of this museum is to give the average individual an insight into the progress of science and industry through the ages.

Prof. Peebles gave a discussion on "Heat Insulation" on November 6. In his talk he treated of the various kinds of dwelling house insulation. He brought to light the fact that aluminum foil, a new type of insulation, is perhaps the best because of its high reflecting surface.

Diversified entertainment continued to be furnished by the society. Mr. Richard Boonstra spoke, November 20, on the subject of "Engineering in Agriculture." He is at present Agricultural Engineer of the Public Service Co. of Northern Illinois. New improvements in farm life and methods of farming have made this type of life attractive once more, according to Mr. Boonstra.

— W. S. E. —

The first meeting of the semester was held October 9. Major Viendells Merick spoke on "Airports, a Division of Transportation." His discussion treated of the factors to be considered when building an airport. Size, levelness, accessibility to customers and aviators, are all to be considered before locating the field. At this meeting a drive for new members was started.

On October 16, Mr. Clarence W. Farrier gave an interesting talk on "Engineering Aspects of the World's Fair." Mr. Farrier is a member of the class of '16. He brought to light the fact that the coming fair of 1933 will have for its chief objective the showing of the progress of science in its application to personal benefits and well being.

The drive for new members was already showing results as early as October 31. On this date Prof. Spears delivered a talk on the buidling of a hangar for the dirigible, 'Akron.' The problem presented, according to Prof. Spears, was an unusual one, due to the immense size the hangar had to be.

The Cover Design

A staff artist's drawing of the fourth completed World's Fair building. A view from the rostrum of the Hall of Science designed by Paul Crit, eminent Philadelphia architect. The building is 700 by 400 feet, two stories and a mezzanine in height. At one corner rises a 176-foot tower fitted with a carillon. The Hall of Science, which is to house the basic and medical science exhibits, stands at sixteenth street and Lief Ericson drive.

OUR VARSITY CAPTAINS

Track.

Charles J. Jens, Jr.

Charles J. Jens, Jr., a senior in the department of fire protection engineering, will lead our track teams, both indoor and outdoor, for the coming season. Although not at all active at track prior to his entrance at Armour, he found himself loving the sport that came to him naturally. This tendency, combined with a great deal of time and

Charles J. Jens, Jr.

hard work on the track squad earned him his present position.

Jens is a product of Park Ridge, Illinois. After graduating from grammar school, he came to Chicago, attending Lane Technical High School. Jens became editor of the Lane Technical Daily. Athletically inclined, he began playing baseball, in which sport he earned his numerals. His executive ability was displayed again when he was chosen manager of the soccer team.

In 1928, "Charlie" received a scholarship for his work and was enrolled at Armour. He soon became known in the literary as well as in the sport circles. By holding the offices of social editor of the Cycle and local editor of the Engineer, his literary ability was soon apparent, being given recognition in Sphinx, honorary literary fraternity.

Jens has been on the track squad for a period of three years. His work there has been ranked very highly. He distinguished himself greatly as a dash-man and also in the weights. His fine work throughout his career has earned him a membership to the Honor "A" Society. Charles is affiliated with the Sigma Kappa Delta social fraternity of which he is vice-president.

Under the guiding hand of Capt. Jens we are sure that the indoor track team will have a most successful season and will surmount all its past performances.

— A. I. E. E. —

Living up to their advance promises of talks by well-known men in diversified fields, Mr. Ludwigson, a representative of the General Electric Co., was guest speaker October 23. The topic of his talk was the use in industry of vacuum tubes and photo-electric equipment.

On November 6, Mr. S. R. Sjoberg, assisted by E. Abin, gave an illustrated talk on telephoto systems. Both men are employed by The Bell Telephone System. The sending of pictures by wire is used quite extensively by newspapers.

At a meeting held November 20, Mr. C. Stecher gave an address on Automatic Train Control Systems. Mr. Stecher, who is a signal engineer on the Chicago and North Western, showed by means of slides that the high speeds of today are safer than the slower speeds of yesterday.

Continuing their policy of educational topics presented in an interesting manner, the society on December 4, showed two reels of moving pictures of the new electrical ship, Virginia. These films were donated by the General Electric Co. Oil is the source of power for motion, light, heat and refrigeration.

— F. P. E. S. —

The mission in life of a Fire Protection Engineer is a varied one, if a listener is to judge by the interesting talks delivered by the assortment of speakers the society has had thus far. At the meeting conducted November 6, Mr. John Neale, chief engineer of the Chicago Board of Underwriters, gave a talk. His topic was "Fire Protection in Builders' Risks." He showed by examples, that fire loss may be prevented in buildings under course of construction. The new Board of Trade Building is the strongest argument for adequate policing of new buildings.

General Frank S. Dixon was the guest speaker for the society on November 20. He is in the engineering department of the National Board of Fire Underwriters. The topic of his discussion was "Organization and Functions of the National Board." In his talk he showed that most of the nation's business is transacted on that faith and confidence which bankers call credit. The backbone of credit, however, as pointed out by General Dixon, is insurance, all of which makes business transactions safe.

Swimmers Ready for Action.

Judging by all indications, the swimming team undoubtedly has great opportunities before it this season. A fine turnout of prospective members and the return of all of last year's swimmers give every reason to believe that one of the most successful seasons is in the offing. The veterans returning for competition are Capt. Weston, Cavanagh, Byanskas, Carlstrom, Thompson, Giovan, Kolve, Davisson, and Pfeiler.

The season ended successfully with the team winning and losing three meets. Weston was high point man of the year. To brighten the prospects further, the three members of the 160 yard relay team, which brought down the Tech record to 1 minute, 21 seconds flat, have returned.

Jerome B. Dirkers, who has been appointed manager of the team, is forming a schedule for the coming season. A tentative report showed that about seven meets will be held. At present the schedule consists of the following meets:

Jan. 14—Crane at Crane.
Feb. 2—Crane at Armour.
Feb. 6—Morton at Armour.
Feb. 25—Armour at Illinois Wesleyan.
March 12 — Armour at Morton.

Basketball Team Starts Season Successfully.

Armour Tech, this year is represented by one of the strongest basketball squads in several seasons. This is due mainly to the return of five regular basketeers who will compose the backbone of the present aggregation. Beemsterboer, Robin, Rossing, Setterberg, and Rummel are the five veterans who have experienced action on a basketball court.

In the first of the two games played this season, the varsity squad emerged victorious. In the annual game against the Alumni the varsity carried away the honors by a decisive score of 44 to 25. Then followed a practice tilt with the University of Chicago. The mettle of the team's ability was exhibited here in a very grand style. Armour with its steady teamwork and well placed shots crept out in the lead and remained there until the conclusion of the game which ended 27 to 19.

Against the much reputed American College of Physical Education, the varsity unloaded a bag of tricks which proved to be very disastrous to the former. The final score read 35 to 21. Being able to handle the basketball as a team enabled Armour to triumph over this quintet.

In their next game with North Central College, Armour received their first setback of the year. Then, to show that the winning habit had not been lost, Armour turned the trick on Crane College two days later. The remainder of the schedule to be played is as follows:

Jan. 12—Y. M. C. A. College at Armour.

Jan. 16—Armour at Augustanta.

Jan. 21—Wheaton at Armour.

Feb. 6—Armour at Michigan Normal.

Feb. 13—Armour at Y. M. C. A. College.

Feb. 17—Armour at Crane.

Feb. 19—Augustana at Armour.

Feb. 25—Michigan Normal at Armour.

Basketball Team 1931-32

Reading left to right; back row: Beemsterboer, Robin, Rossing (Capt.), Setterberg, Christoph, P. Flume. Middle row: Rummel, MacLennan, Owen, (Mgr.). Front row: Colattz,, Staron, Humiston, Ly Ford.

Great Season in Store for Boxing Team.

With the return of a greater part of last year's team, a most promising season is assured for Coach Weismann's squad of pugilists. Captain Sandstrom, Heckmiller, Campione, Rush, Bacci, Milevsky, and Hoffberg, constitute the veteran nucleus of the present boxing team. Under the personal supervision of Coach Weismann these men are certain to further their knowledge of the manly art.

The school tournament, starting November 20, disclosed the sparring abilities of quite a number of men. Koko, Donelly, Gaemer, Core, Marcus, and MacDonald showed rare form in their various matches. The addition of this new material to the squad greatly increases the possibilities of a successful season. The interest created by this tournament has increased the number of those seeking berths on the team to forty candidates.

Manager Frank Ustryski, captain of last year's team, has already arranged a tentative schedule with several colleges. Matches with the South Chicago Y. M. C. A., Valparaiso and Culver have been chosen. The boxing season will officially open on January 13, when Armour will meet the 124th Artillery Armory, at the latter's gym.

— A. C. S. —

At a meeting held October 23, at the City Club of Chicago, an interesting lecture on "The Chemical Constitution of Celestial Matter" was given by Professor Harvey Lemon. Although this was the principal talk of the evening, talks on a variety of subjects were given by other members of the society. Vandermeer Vookes, of the Standard Oil Co., discussed the extraction of lubricating oil from paraffin wax, and Prof. Hastings, of the University of Chicago, gave a talk on biological chemistry.

On November 20, Prof. Worth Rodebusch gave a talk on "Molecular Rays." The meeting started, as usual, with a dinner, after which came Prof. Rodebusch's talk and also a discussion by Mr. Paul Leech on the "Examination of Medicinals."

Alumni Basketball Team Bows to Varsity

In a practice game held December 1, the Alumni succumbed to the superior team play and talent displayed by the varsity, to the tune of 43–25. The team which started against the Alumni is one of the finest aggregations Coach Kraft has turned out in his long career at Armour. The honor of making the first point went to the Alumni, when Guthman sank a free throw after being fouled by Setterberg. This lead was dissipated, however, in short time. The score at the half stood 28–10 in favor of Armour. Outscored and lacking the team play which characterized the play of the Varsity, the Alumni made up for it by their fight and splendid spirit.

— A. I. Ch. E. —

On November 6, a lecture on the "Crushing and Sampling of Ores," by a representative of Raymond Brothers Pulverizing Company was given.

A banquet was given to the Chicago Chapter of the A. I. Ch. E. by the Armour Chapter, November 13, at Armour cafeteria. Following the banquet the visitors were shown through the Institute—particularly the chemical laboratories. Talks on "What a Chemical Engineer is Expected to Know" were given by various members of the visiting chapter.

"Purpose of the World's Fair," was the subject of a talk by Mr. R. B. Harper, vice-president of The Peoples Gas, Light & Coke Company, on December 11.

Enrollment

Below will be found a summary of the registration as obtained from the Dean's office. The statistics will be found tabulated both by the number registered in each class and also, the number in each department. The total enrollment is now 830 as compared with 828 enrolled for the fall term in 1930.

	4	3	2	1	Sp.	Tot.
M. E.	34	33	56	52	3	178
E. E.	29	35	49	58	2	173
C. E.	31	27	51	44	2	155
Ch. E.	18	26	29	35	1	109
F. P. E.	22	23	25	21	0	91
Arch.	17	35	35	35	2	124
Total	151	179	245	245	10	830

Tau Beta Pi

Eight men were pledged to Tau Beta Pi, honorary engineering fraternity, at a smoker held in November. They are:

G. L. Bonvallet, E.E., '32.
W. G. Buehne, M.E., '33.
A. J. Jungels, M.E., '32.
T. A. McGill, E.E., '32.
M. J. Schinke, E.E., '32.
G. W. Schodde, F.P.E., '32.
J. T. Sorensen, F.P.E., '33.
R. F. Waindle, M.E., '32.

The gathering was well attended by faculty and alumni members.

Sphinx

The honorary literary fraternity, Sphinx, is watching closely the efforts of outstanding men on the Armour publications. To those who indicate a high degree of ability and perseverance in their work, the group will extend the privilege of pledgeship early this spring.

A smoker is being planned for the near future. Some man prominent in the journalistic field will be invited as speaker of the evening.

Chi Epsilon

Six men have been pledged to Chi Epsilon, honorary civil engineering fraternity.

Two members of the faculty, Professor E. C. Grafton and Professor Herbert Ensz have been accorded honorary membership. The student pledges are:

C. H. Fox, '32.
W. H. Hornberger, '32.
L. A. Mueller, '32.
E. J. Wiltrakis, '32.

Pi Nu Epsilon

At a meeting held late in November, Pi Nu Epsilon pledged six men. The men selected for membership in the honorary musical fraternity are:

W. C. Breh, E.E., '32.
J. A. Clear, M.E., '32.
W. W. Lange, EE., '33.
J. S. McCall, M.E., '32.
H. P. Richter, E.E., '32.
H. W. Richter, C.E., '32.

A theater party was held in January and was well attended by pledges and members.

Alpha Chi Sigma

Alpha Chi Sigma, honorary chemical professional fraternity, has elected for its officers, the following men:

President .... O. G. Linnell
Vice-President .... S. Johannisson
Recording Secretary ...... A. M. Ream
Corresponding Secretary ....
.... J. O. Cavanagh
Alumni Secretary .... A. F. Bigelow
Treasurer .... P. Bestler
Master of Ceremonies ....
.... G. J. Stockmann

Junior Dance to be Held in February

The second school dance of the year, the Junior Informal, is to be held February 19th in the beautiful Oriental room of the Hotel Knickerbocker. A great evening is promised by the committee in charge of arrangements which is headed by the Junior Class Social Chairman, H. W. Bodinson. To those attending the school dances in the past this promise is, of course, unnecessary as they know what is in store for them.

In spite of a so called "repression" one of the largest crowds ever to attend an Armour dance, was in evidence at the Senior informal and there is every reason to believe that the Junior dance will bring forth an even greater attendance.

The bids will sell at the usual price of $2.50, and will be available in a short time from any member of the Junior social committee which is made up of:

H. W. Bodinson, Chairman
Arthur W. Oberbeck
Thomas D. Luckett
William W. Lange
Jack R. Pechman

Interhonorary Banquet

The fifth annual Interhonorary Banquet was held on the evening of December 16, 1931 in the Silver Room of the Hotel Knickerbocker. Many faculty members and about seventy of the active and pledge members of the scholastic, literary, and musical honor organizations were present.

The location was very apt toward promoting a fine spirit of friendship and cordial conversation among the men present. Professor Heald served as toastmaster and briefly introduced Dr. Scherger, who spoke in a very interesting manner on the tendency of the engineer to become self-centered and to narrow his interests and activities. Dr. Scherger then introduced the main speaker of the evening, Postmaster Arthur C. Lueder.

Postmaster Lueder's discourse was very illuminating, and gave the assemblage a very clear view of the immensity of the work of the United States Postal Service, and its educational work.

Prof. Bibb Returns

The Department of Mathematics has been unfornate this year due to the illness of Professor Samuel Fletcher Bibb. Many students had probably missed his cheery face about the campus. Professor Bibb was at Armour September 21 to do his part in the enrolling, but immediately after that, was confined to bed, where he remained for some length of time. However, Professor Bibb is again back in school and at the old job.

Professor Hull took charge of Professor Bibbs classes during his absence. Professor Hull has had five years of teaching experience some of which was obtained at the University of British Columbia. At present Professor Hull is working at the University of Chicago on his doctor's degree.

Salamander

An initiation smoker was held on December 9, at the Beta Psi house. Carl Clanton, '33, was initiated in the honorary fire protection engineering society. Professors Finnegan, Robinson, and Holmes, honorary members of the fraternity, were present at the meeting. Following the more serious part of the evening, refreshments were enjoyed by all.

Phi Lambda Upsilon

Phi Lambda Upsilon, honorary chemical engineering fraternity, has pledged four men. They are:

L. W. Krizan, '33.
H. Fishman, '33.
F. W. Paine, '33.
G. J. Stockmann, '33.

The pledging smoker was held in the Tau Beta Pi rooms and was an occasion for a congenial get-together of faculty and student members.

Pi Tau Sigma

Pi Tau Sigma, honorary mechanical engineering fraternity, announces the following pledges:

R. F. Beattie, '32.
W. G. Buehne, '33.
J. M. Clucas, '32.
L. R. Newton, '32.
V. R. Sandberg, '32.
L. W. Winbolt, '32.

At the annual convention held at the University of Missouri, Professor Roesch was elected supreme vice-president of the organization.

Eta Kappa Nu

The honorary electrical engineering fraternity, Eta Kappa Nu, recently initiated two juniors and five seniors. They are:

H. F. Abendroth, '32.
W. C. Breh, '32.
J. W. Juvinall, '33.
P. H. Korrell, '32.
J. A. Meuret, '32.
H. W. Richter, '32.
R. F. Rychlik, '33.

The next national convention in 1933, will be held in Chicago. This was decided at the last meeting held this fall, at Cornell University.

Musical Club

Officers of the Musical Clubs, were elected at the close of the spring semester. The men elected at that time are as follows:

President .... J. E. Walker
Vice-President .... J. S. McCall
Business Mgr. .... E. W. Carlton
Sec.-Treasurer .... T. A. McGill

A large number of charms were awarded to men active in any one of the musical organizations for one year.

The Armour Alumnus

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Louis Céllestin Monin — *An Appreciation*

By Howard Monroe Raymond

ON November 8, 1931, word was received at the Institute that our revered friend and colleague of many years had passed away. The news of his death, cabled by Mrs. Monin, came as a shock to all of his old friends, though not entirely unexpected. Throughout the last summer he had seemed better than for several months and even well enough to spend two weeks, accompanied by Mrs. Monin, at Brunnen on Lake Lucerne. The photograph heading this article was his last, taken at Weggis, near Brunnen, on July 6, 1931. He spoke of this spot as the most beautiful in all Switzerland. After this short vacation he and Mrs. Monin returned to their home in Zurich, where he seemed to have benefited from the change but suffered a relapse in late October, from which he did not recover.

Much has been written about Professor Monin, and the graduates and former students who were in his classes know much of his history. They know of his student days at Leipzig, Zurich, and Heidelberg. Through him they felt an acquaintance with the traditions and ideals of these great universities, and even of the professors whose teachings were reflected in our own Professor.

Professor Monin came to the United States in 1888 and to Chicago in 1890. He taught in the Harvard and University Schools of Chicago, and at the same time tutored sons and daughters of prominent families. At the opening of the Institute in 1893 he became a member of its faculty, and taught languages, economics, and philosophy. During summer quarters, for several years, he was Docent in Philosophy at the University of Chicago. In later years he discontinued the teaching of languages and confined his classroom efforts to economics, logic, and psychology. He was a profound student of the theory of education and the art of teaching, and in the summer quarter of 1900 was Assistant Professor of Education at the University of Chicago.

Professor Monin was born in St. Gall, Switzerland, November 9, 1857; the son of Louis Celestin and Marie Magdalena Euphrosina (Hool) Monin; graduated from Gymnasium, St. Gall, in 1878; student, University of Leipzig, 1878–1879, University of Zurich, 1879–1881; Principal high school, Canton Glarus, Switzerland, 1881–1883; student and tutor, Milan, Italy, 1883–1885; student, University of Zurich, 1885–1886, University of Heidelberg, 1886–1888; received Ph. D. degree from Lake Forest University of 1892; married Cathinka Elizabeth Weiss, of Heidelberg, Germany, in 1887 (who died in 1921); married for second wife, Elise Rose Urfer of Thun, Switzerland, 1922, who survives him.

He was principal, Armour Scientific Academy, 1898–1899; was successively Professor of Modern Languages and Instructor in Philosophy, Professor of Economics and Philosophy, Dean of Cultural Studies, 1903–1922; Dean, College of Engineering, 1922–1926.

Latest Photo Taken of Mr. and Mrs. Louis Celestin Monin

Professor Monin was of noble ancestry. Through his veins flowed the blood of the aristocracy of Europe. His great, great grandmother, Empress Josephine, was connected with many of the royal families of Europe. The name of her daughter, Hortense Beauharnais, his great grandmother, will always be intimately connected with the Napoleons, through the rise of her son as president and later Emperor of France—Napoleon the Third. Her last home, the castle of Arenenberg, now a villa on the shore of Lake Constance, was a very dear spot to Professor Monin, and he never failed to visit it on his trips to Switzerland. Empress Eugenie, wife of Napoleon III, who died in 1922, was his great aunt.

Never did there live a man who carried his inherited characteristics more nobly, nor who lived a more complete and useful life. The struggles of his early youth, coupled with the training of a superior mother, prepared him

(*Continued on next page*)

Mr. Oswald Exhibits His Ability in the Field

Among the contributors in the November issue of "Bell Labroatory Records," a publication of the Bell Telephone Laboratories, Inc., appears the name of A. A. Oswald. Mr. Arthur A. Oswald received his B. S. degree in electrical engineering at Armour in 1916, and his E. E. degree in 1927. After graduation he was employed in the Bell Telephone Laboratories and has been in their employ since 1916. During this time he has been continuously engaged in successive radio projects. He took part in the development of long-wave transatlantic telephony, and was at Montauk for the early transmission experiments. During the World War he had charge of the field-testing of airplane-telephones for the Signal Corps, and to him is given the credit of devising a method of radio-control for airplanes in flight. From 1919 to 1922 he played an active part in the development of ship-to-shore communication. Since then he has been concerned with the long-wave and short-wave transoceanic systems.

Proof of Mr. Oswald's scholastic ability may be evidenced by the fact that he belonged to Eta Kappa Nu, Tau Beta Pi, and Beta Psi. He secured his high school education at the Great Falls High School in 1911.

Thanks

Due to the wonderful cooperation this year between, Mr. Hirsh, Secretary-Treasurer of the Alumni Association, and Miss Jones, Secretary of the President's office, returns of mail, due to incorrectly addressed letters, were the smallest in a great number of years. Out of 3100 letters that were mailed, there were less than 2% returns, while in previous years, 10% returns were considered to be good. There must be some reason for such surprisingly good results, and, obviously, the reason is Miss Jones. Mr. Hirsh takes this opportunity to sincerely thank Miss Jones for her wonderful cooperation.

A most comprehensive treatise on "Oil Requirements For Modern Rolling-Mill Circulating Systems," was recently written for publication by C. M. Larson, M. E., '13. Mr. Larson, upon receiving his B. S. in M. E. at Armour, in 1913, became Lubrication Engineer with the Texas Co., soon afterward only to be advanced to Chief Engineer of the Chicago district, in charge of lubrication service engineers, comparative tests, lubrication equipment installation and the development of new products. He served as Wing Lubrication Engineer, 1st Lieut., Air Service, U. S. Army, during the war. He now holds the position of Supervising Engineer, of the Sinclair Refining Co.

Louis Célestin Monin

—An Appreciation

(Continued)

for the vicissitudes of life beyond the experiences of the average young man. He was a gifted teacher and a great lover of youth. His university training, under the most famous teachers of Europe, added to the background of a career for which he was especially fitted.

Thirty-four years of his life was spent in the institution he loved so well, and his affection was worked into and through the whole fabric of its varied interests. But it was with the students that he delighted to mingle, and everyone thought of him as a sincere and sympathetic friend. He was ready always to assist the boys who needed help, and his power to help extended in many directions. This desire to be of service was one of Professor Monin's strongest characteristics, whether it was advice or whether it was direct assistance that was wanted. His arm was long, his sympathy unlimited, and his ways were helpful as well as tactful. Among his more intimate friends there is an overwhelming sense of loss beyond and above the activities that radiated from his desk as Dean or from his platform in the classroom. His fund of good cheer, his appreciation, or his sympathy, was spontaneous; it came from the sunshine and the sincerity of his soul.

We mourn with profound grief, the irreparable loss of our former Dean and Professor, beloved, admired, revered, as teacher, scholar, and friend. We are thankful for this leader and commander of youth; his rare gifts, his gentle, strong, lovable nature; his high spirit, his rich and tender humanity, and his wide, prevailing power of life. With chivalry and courtesy he bore himself alike to all men, and none met him who did not feel that in Professor Monin stood a friend. He was the perfect companion.

We are grateful for the honor of his friendship and so many years of close association. Unselfish, loyal, and affectionate, intimate relationship with Louis Celestin Monin was a rich experience, long to be cherished in memory.

"None knew him but to love him; none named him but to praise."

O. A. Anderson Heads Department at Armour & Co.

O. A. Anderson, '15 who has been employed with Armour and Company, since has graduation, was recently placed in charge of the new mechanical Engineering department. Mr. Anderson has been at the head of this department since 1929 but only recently its scope was widened to include also the Architectural and Construction department of the company.

Mr. Anderson entered the service of Armour and Co. as a junior engineer in June 1915, immediately following his graduation from the Institute. His first permanent job with the company was maintaining efficiency in power plant operation. In 1919 his duties were broadened to include mechanical supervision of the smaller plants which were a part of the organization. He was given charge of the installation and operation of mechanical equipment at all Armour branch houses throughout the country in 1924 and in 1929 he was appointed head of the Engineering department.

Last August the Architectural and Construction departments were consolidated with the Mechanical Engineering department with Mr. Anderson as head of the group.

Milton John Abrahamson, C. E., '28 has recently announced his engagement to Ethel Nachman. Miss Nachman is the daughter of Professor Nachman, who teaches Thermo-dynamics at Armour.

Mr. Abrahamson is now employed in the surveying of streets and roads by the Illinois Highway Commission. While at Armour Mr. Abrahamson was active on the swimming team, having won his letter twice in that activity.

With the opening of Armour Institute in 1893, P. M. Clemen, then a young man, began his college career by enrolling in the department of mechanical engineering. After two years, Mr. Clemen dropped from school and until recently no word had been heard from him. Now, news has been received that he is engaged in mechanical engineering work, the greater share of his time being spent in Winnipeg, Canada.

Dr. Raymond Receives Many Alumni Letters.

A cheery Christmas letter was sent by Dr. Raymond to the numerous alumni of the Institute. In the past few weeks Dr. Raymond has received a great number of encouraging and most inspired letters from many of the alumni acknowledging his Christmas greeting.

As a representative letter of these, below, will be found the letter written by John L. Nagle, x '15, who is at present, employed as designing engineer with the Arlington Memorial Bridge Commission. His letter follows:

Dear Dr. Raymond:

Many thanks for the cheery picture and cheerful thought in the letter from your office which I recently received. Word from Armour never fails to set up warm currents in my thoughts, and I am confident that all other recipients of your letter were likewise affected.

Although it now approaches 20 years since I was at school, it is only quite recently that I have realized the truer nature of the things that I learned there. These were not the—ics, although the latter were valuable enough. The human touch is what I got that counts the most. My life prior to my brief term at school, had not afforded me contacts with men of sincere and exalted purposes such as I met for the first time at Armour. So subtly did these men work on me—but so surely—that it was not for more than 15 years after I left school that I was conscious of their full influence on me. I mention here the names of only three of these men, now no longer with us, but the memory of whom shines brightly,—Monin, Phillips, Palmer.

"Verily" (as I have read somewhere), "a kind word, a good deed, is like an acorn planted in the ground. It lies long unnoticed, ungerminated, among the pebbles and soil, but finally springs up into an oak that towers above that which once hid it and attempted to smother it." Such words and deeds taken for granted in the hustle of the present, finally forge the chains of memory and gratitude that bind one to the giver more securely than could iron and steel.

With my best wishes that Armour may enjoy another and many more successful years, and with my kindest personal respects to all the gentlemen of the faculty whom I know, I remain,

Very sincerely,

John L. Nagle, x '15.

V. V. Poupitch, M. E., '29 has successfully completed the U. S. Government examinations for a commission in Aeronautics. He will participate in the commencement exercises to be held at March Field, Riverside, California, on June 18th.

The coveted position of supreme vice-president of Pi Tau Sigma, national honorary mechanical engineering fraternity, has fallen to Daniel Roesch, professor of automotive engineering. He is the first Armour man to be so honored.

Treasurer's Report of the Armour Alumni Association

Balance on hand 12-1-30	$ 608.29
Income	
Dues	1448.50
Interest on Trustees Fund	160.00
Interest on Students Loan	162.85
Total	$2379.64
Disbursements	
Life Membership turned over to loan fund	$ 40.00
Exchange	.55
Stationery, postage and printing	521.40
1930 Banquet Expenses	71.60
Armour Engineer	447.47
Addressing	52.08
Miscellaneous	2.63
	$1135.73
Balance 12-17-31	$1243.91

Class of '07 Lay Plans For Reunion

Elaborate plans for the alumni reunion, which is to be held sometime in the middle of May, are being worked out by the committee in charge. To those alumni who yet do not know exactly what this reunion is and what it means to Armour alumni, we will explain briefly. Last year the class of '06 sponsored a reunion or class get-together which turned out to be an extraordinary success. The sentiment brought out at that time showed everyone to be in favor of instituting the reunion as an annual affair. Consequeutly this year the second annual reunion will be held under the auspices of the class of '07. It is intended that each year the class whose twenty-fifth anniversary is marked by that year, will sponsor the reunion. However, this statement is not meant to be interpreted that the reunion is of and for the class of '07 only. It is given by the class of '07 for all alumni of Armour Institute. Every alumnus is not only cordially invited to attend but is expected to be there if such a task is humanly possible.

The exact date of the reunion has not, as yet, been definitely set. However, an effort is being made this year to hold the gathering on the day of Open House at the Institute. Many have expressed their desire to meet some of their old professors and associates, and to visit once more the halls of learning where they toiled for at least four, and possibly five or six years. Open House will be either the first or second Monday in May, but when the date is definitely decided upon the Alumni will be notified through the medium of these columns.

A plea has been made for all men of the class of '07 who are interested, to get in touch with Clarence Smith '07, who is chairman of the committee in charge of arrangements. Mr. Smith may be reached at 3200 Summit Avenue, Milwaukee, Wisconsin.

The complete plans for the reunion will be published in the March issue of the Armour Engineer.

Jennings Adds More Tennis Titles

George Jennings, X-'30, spent another very busy summer gathering up his quota of tennis titles. Jennings has gradually risen in tennis circles until at the present time his ability is recognized throughout the country. A few of the titles he annexed to his already brilliant array are: Western indoor tennis title, Mississippi Valley title, and this year marks the winning of his fourth consecutive Public Parks singles championship. Probably his most outstanding match of the year was the decisive trouncing given Japan's Davis Cup star by scores of 6–3, 6–2, 1–6, 6–2.

New Officers Elected at Banquet in December

The annual alumni banquet was held in the Rose room of the Morrison Hotel on Thursday, December 17. Although the meeting was not as well attended as it has been in some previous years, the turnout was encouraging to those in charge of the arrangements, who so faithfully worked to put over this annual get-together. Many new faces were among those present as well as a good many of the old reliables.

A scene at the Alumni Banquet which was held on December 17, at the Morrison Hotel.

During the course of the dinner the old as well as the young, alike, were given an opportunity to expand their vocal chords in a bit of informal—yes, quite informal—singing.

It need not be mentioned that the toastmaster duties of the evening were well taken care of when it is known that they were handled by John Schommer, who again featured the evening with his repertoire of stories.

The principle business of the evening, of course, was the election of officers for the ensuing year. The president of the association, John Schommer, was reelected as was the secretary-treasurer, Louis Hirsh. The complete list of officers is as follows:

President—John Schommer.

Vice-President—Henry W. Clausen.

Secretary-Treasurer—Louis Hirsh.

Board of Managers—Clinton E. Stryker, Henry W. Regensburger, Charles W. Burcky.

Advisory Council—Morris Wisner Lee, Charles W. Hills, Jr.

The business of the evening was brought to a close with the reading of the treasurer's report for the past year. This report will be found elsewhere on the preceding page.

As was promised, no long and boresome speeches were in order, the speaker of the evening on the contrary was in every degree entertaining and brief. It must be admitted by all who listened to his speech, that his views on "the depression," his subject, were enlightening as well as novel.

All who attended can well look back on such an enjoyable evening as well as look forward to all such gatherings with their old classmates in the future.

Many Recent Improvements Made at the Institute

Important changes in classrooms and laboratories that have taken place in the past year have made the old familiar halls of learning appear quite unfamiliar to many visiting alumni. For the benefit of those who have been unable to visit the Institute recently we will attempt to describe a few of the major changes that have been made, tending to enhance both the beauty and the serviceability of tthe classrooms and laboratories.

Physics, metallurgy, and chemistry laboratories, Armour's radio station, and the electricity laboratory all enter into the remodeling projects.

The Physics laboratories have enjoyed a goodly number of improvements. The laboratories on the first floor of Chapin Hall, which have hitherto been separate and unconnected, have been brought together by tearing down sections of walls and placing doors in their stead. One may now walk directly through three separate laboratories. Each of these laboratories has a definite purpose, one is used exclusively for the study of Mechanics, another is devoted to Heat and Sound, and the third to Light. The classrooms are also found on the first floor. On the second floor there appears a practically new laboratory. New and exceedingly precise and valuable instruments are found in abundance. This laboratory is devoted to Electron Physics. Among the new instruments may be found two complete vacuum lines, X-ray tubes, two quadrant electrometers, a Millikan oil drop for determining the charge on the electron, two gold leaf electroscopes for radio measurement, a quartz mercury arc to determine the ultra-violet charge, and photo-electric cells. Besides these instruments, there abounds various and numerous complicated glass setups which Professor Thompson of the Physics Department has spent well unto six months in fabricating.

Akin to the above description may be mentioned the moving of the electricity office in order to provide room for increased laboratory facilities. Donations of instruments have been received by this department from the American Telephone and Telegraph Co. and from the Illnois Bell Telephone Co. Among the most valuable of these instruments are an artificial line and a variable frequency oscillator.

In the jurisdiction of the Department of Physical Education one may find an entirely new office recently constructed for the use of Mr. Krafft. The former office is used exclusively by the medical adviser for examining students.

Thus one may readily see that the officials of the school are constantly endeavoring to better the students in engineering by increasing the facilities and improving the conditions under they must work.

Safeguarding the Conflagration Hazard

(*Continued from page 39*)

such ideal conditions did exist there still would be a necessity for window protection for in this area exist the greatest possibilities for a devastating conflagration which would be above the reach of the fire departments. In a fire resistive building there is an average of five pounds of combustible trim and ten pounds of fuel in rugs, furniture, books, and the like for each square foot of area. The fuel value of this total is equal to about two-thirds of a gallon of fuel oil. This shows that it is never possible to have everything fire resistive and the necessity for window protection is always apparent.

The protection devices which are now used and are listed by Underwriters' Laboratories include water jets or open sprinklers, steel shutters, metal or metal covered window frames provided with wire glass windows, and metal sash. Which single device or combination of devices to be used is determined by the character of the various exposures. The exact degree of an exposure cannot be readily determined although it can be closely approximated. The determining factors are the construction and occupancies of the exposed and exposing buildings.

For severe exposures any of the following combinations is desirable: Metal frame and wire glass windows with steel plate or tin clad shutters; metal sash with steel plate or tin clad shutters; and wooden window frames provided with sheet metal shutters fitting into grooves in the wall. For moderate exposures the following possibilities are forwarded: Metal frame and wired glass windows with an area less than 720 square inches; and wooden window frames protected with sheet metal plates or tin clad shutters. For light exposures metal frame with wired glass windows or open sprinklers should be sufficient. Each device mentioned is treated separately in the paragraphs following.

For moderate exposure, wire glass windows in metal frames are very serviceable. Their appearance is a decided advantage in their favor over shutters, although they are less efficient. Whether the glass be polished, ribbed, webbed, or dull, it does not stop radiation and this type of protection cannot be offered as a capable substitute for shutters as a conflagration barrier. However, their combination does form a very good fire stop.

Wire glass itself consists of a wire mesh within glass varying from one-eighth to one-half inch in thickness. The frames in which the glass is enclosed vary in design and structure and will be considered separately. The most widely used of these types is the hollow sheet metal frame. The metal is of sheet galvanized-iron or copper and of at least No. 24 gauge if iron be used or of at least 20 ounce copper if that metal is used. Copper is less desirable than iron because of its low fusing point but is better in localities where the atmosphere is damaging to iron. This type of window deteriorates rapidly if neglected.

Wrought and cast iron frames loom as a very favorable type because of their resistance to strong exposure and atmospheric conditions. The frames are made of $3\frac{1}{2}$ inch by $\frac{3}{8}$ inch flat iron, welded so as to be one continuous frame. This type is as thorough a fire resistive type as can be had with the use of glass. In power houses this design is very practical because a maximum amount of light can be admitted and the windows can be easily regulated.

Drawn bronze windows, while incombustible, are not fire resistive windows in the conflagration sense.

Many of these types of windows are self closing. Their frames are usually of solid iron and they are closed by the fusing of a properly placed link. This type is used in certain types of mercantile risks and to a large extent in factories.

> A Vision
>
> *I saw Eternity the other night,*
> *Like a great ring of pure and endless light,*
> *All calm, as it was bright:—*
> *And round beneath it, Time, in hours, days, years,*
> *Driven by spheres,*
> *Like a vast shadow moved; in which the World*
> *And all her train were hurled.*
>
> —*H. Vaughan*

In a final analysis of all the types of glass windows, it will be noted that no matter how efficient any single type may be, its value is considerably increased by the additional use of one of the several classes of shutters which are to be described in the following material.

Shutters for fire protection purposes are of three main types: those shutters of wood covered with lock-jointed sheet tin; sheet or corrugated iron shutters; and rolling shutters of interlocking metal which are rolled up and down in a manner similar to curtains. Rolling shutters can be used on the inside of the window while the others necessarily have to be placed outside. Severe tests have caused all three types to fail, but in actual practice they stand up very long and remain the best single type of window protection available. In most cases the only possible failure of a shutter is due to faulty installation of the device.

The features of fire resistance, resistance to radiation, and capability of being opened from the outside should all be combined in the construction and installation of a shutter.

Tin clad shutters are usually made of two thicknesses of one inch tongued and grooved boards laid at right angles to each other and fastened together by wrought iron nails. The woodwork is completely surrounded by tight fitting, lock jointed sheet tin. The wood core provides the strength and rigidity to the covering. In this fact lies the whole weakness of the tin clad shutter. Intense heat burns or decomposes the wood and the gases yielded burst the tin open to destroy the value of the device.

The use of sheet iron shutters has fallen off greatly since incombustibility has not been considered the same as fire resistance. These shutters, made of number fourteen gauge sheet iron, radiate heat readily and expand and warp under moderate heat. Then excessive weight lends them an undesirable characteristic while their neat appearance adds to their favor. At one time the sheet iron shutter was used quite extensively but in recent years it has given way to the use of more reliable shutters.

A similar device to the last mentioned shutter is the one made of number 22 gauge corrugated galvanized steel sheets. Between two of these is a sheet of 12 pound asbestos.

All the forementioned shutters are of the non-automatic type. For this reason a final and better type of shutter is to be considered. In a large building it is hardly possible to close every shutter at the end of each day.

The best kind of shutter is the rolling steel window type designed to protect openings of not more than 100 square feet in area. Such curtains are made up of interlocking sections of galvanized steel coiled upon a barrel and having the vertical edges traveling in grooves. The device is normally open but closes by a releasing device started by the melting of a fusible link at 150 degrees F. A chain within the building permits the closing of such shutters without the fusing of the link. This feature enables the shutters to be closed before the necessary temp perature is reached. Rolling shutters are made in two styles; one type is invisible while open and is installed in new buildings only while the second can be applied to any type of construction. In the U. S. Appraiser's Warehouse in New York the windows on one floor are provided with this type of shutter and can be operated simultaneously by an electrical connection.

The good appearance of this type of protection has made it an especially desirable architectural as well as fire protection practice to incorporate this type of window protection in the design of a building. The San Francisco disaster demonstrated the efficiency of rolling shutter protection. It has been proved that rolling shutters when used with either wired glass or open sprinklers are surpassed only by solid masonry walls for fire resistive qualities.

Open sprinklers, often called water curtains, cannot be called a conflagration barrier when used alone and in no sense can be classed as alternatives for wire glass windows and metal shutters. An open sprinkler expels a sheet of water over the entire window and frame as well as the shutters, if any. Their efficiency is reduced somewhat because they are dependent on manual control for their operation. No automatic leads or alarm valves are contained in such a system. The heads are connected by piping to either the inside or outside of the building. The pipes are readily filled with water from some constant source by means of valves easily accessible. The distribution of water from such a system is far more complete than if done by hose lines. Windows less than 60 inches wide need but one head from which to spray water. It falls on the upper half of the window and then runs over the rest of the sash and glass, wetting the entire surface. The sheet of water has a very good cooling effect but it fails to prevent the radiated heat from entering the building because radiant heat readily passes through all transparent liquids and solids.

The real value of open sprinklers lies in their qualities as reinforcements to wire glass windows and metal shutters. The cooling effect of the water curtain prevents the warping of metal doors

(*Continued on page 62*)

PERILS OF PROSPERITY

Proud Papa: "Don't you think its about time the baby learned to say 'papa'?"

Mother: "Oh! No! I hadn't intended telling him who you are until he becomes a little stronger."

She: "Promise me you'll love me as long as you live?"

He: "Cross my heart and hope to die."

Willie: "Pa, what's a peanut politician?"

Pa: "One that improves with roasting."

Jitts: "Well, anyway, no one can say I'm two faced."

Jungles: "Of course not; and if you were you'd leave that one at home."

"Did you read about the golfer who was hanged yesterday?"

"Yes, as his last request he asked for a few trial swings."

Mac: "I think she must be spoiled."

Carlson: "No, its just the perfume she's using."

"Who the deuce do you think you are?"

"I'm just a little dandruff trying to get ahead."

FINE INDEED

Officer (to couple parked in auto): "Don't you see that sign 'Fine for Parking'?"

Otto: "Yes, officer, it certainly is."

The absent-minded professor we'd like to meet is one who would lecture to his steak and cut his classes.

Judge: "How old are you?"

Mandy: "I'se seventy-three, judge."

Judge: "Are you sure?"

Mandy: "Yes, sah, I thinks so."

Judge: "You certainly don't look that old."

Mandy: "Well, judge, then it must be my waist measure."

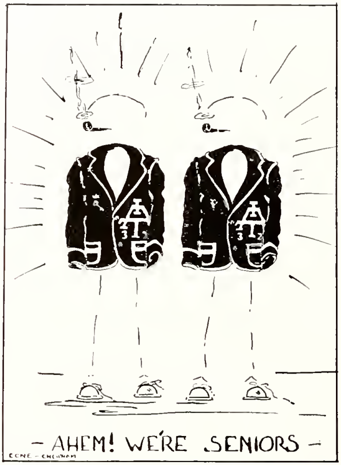
Andy: "Do you know what surrounds the ocean, Amos?"

Amos: "Sho', Andy, sho'."

AU REVOIR

Judge: "Now, I don't expect to see you here again, Rastus."

Rastus: "Not see me here again, Jedge. Why you all ain't going to resign yo' job, is yo' Jedge?"



HAM AND DIAMONDS

The lunch counter man goes to work for Tiffany

First Customer: "I would like a lady's wrist-watch."

Salesman (bellowing lustily): "One Waterbury on a handcuff, female."

Second Customer: "May I see some matched pearl necklaces, please?"

Salesman: "I've got just what you want." (bellowing) "Fifty oyster tumors on a rope, line 'em up! Who's next?"

Third Customer: "I want a ring—an engagement ring—platinum with a diamond, about two karats."

Salesman: "Coming up!" (bellowing) "One tin shackle with a glass eye—two vegetables! Next."

Young Mother: "I want some jeweled safety-pins for-for-a young baby's - er - garments, you know."

Salesman: "Well-er-I'm sorry, madam, but you'll have to go to someone else. I'm new here."

—LIFE.

DON'T EAT—LISTEN

He sat down at a highbrow restaurant, pointed to a line on the French Menu and said, "Bring me some of that."

"Sorry sir," answered the waiter, "the orchestra is playing that."

Young Lady (just operated on for appendicitis): "Oh, doctor, do you think the scar will show?"

Doctor: "Not if you are careful."

Teacher: "Isaac, what's the difference between electricity and ligthning?"

Isaac: "Ve dun't hav' to pay for lightning?"

Stud: "How do you spell financially?"

Herr Louie: "F-I-N-A-N-C-I-A-L-L-Y, and there are two R's in embarrassed."

"Well, my dear," said the rich man now poor again, I've given up six servants, including the chauffeur."

"Don't tell me I have to drive myself," snapped the wife frostily.

"No, no," sighed the man. "I had to let the car go too."

From the Passing Show we find this: "A man usually enters a speakeasy optimistically — a n d comes out misty optically."

WHY NOT!

"Doctor, after my finger heals will I be able to play the piano?"

"Certainly, certainly!"

"S'funny—I couldn't play it before."

The loon is a funny bird, but it takes the stork to kid us along.

"Do you come from Boston?"

"Hell, no! I'm only talking this way because I cut my mouth on a bottle."

Now that the "roll your own cigarette." movement is under way, we may expect to see the drug store cowboys rolling them with one hand while spinning on the stools.

"Ma, when people go into mourning do they wear black undercloths?"

"No, dear."

"Why, do they only feel sad on the outside?"

Arc Welding, In Steel Construction

(*Continued from page 42*)

This current is far in excess of the normal carrying capacity, and as the point of highest resistance is at the ponit of contact, the heat is concentrated there. When the temperature at the junction reaches the correct value, which may take place within a fraction of a second, the two pieces are pressed or clamped together and a weld results. Because of the heavy equipment needed both to produce the large current required and to clamp the two members together, it is not practicable to make this apparatus portable. Consequently, resistance welding is not used in structural steel construction, although studies have been made in regard to its possibilities for welding battledeck floors and similar sheet metal work used in connection with building construction.

As its name indicates arc welding utilizes the electric arc to produce the heat necessary for fusing the two members together. The arc is struck between two electrodes. These may consist of the base metal and an electrode held in the operator's hand, or they may be two separate electrodes. The electrode held in the operator's hand may be of several kinds. It may be of carbon, in which case the operator must use his other hand to hold a filler rod. The inconvenience of holding the electrode in one hand and the filler rod in the other makes the carbon arc impractical for building construction use, although there are special cases where it can be used to advantage. The electrode in the operator's hand may be of metal. This is the type used almost exclusively in the welding of structural steel. The electrode consists of a mild steel wire held in an electrode holder connected by a flexbile cable to the generator. The diameters of these electrodes range from one sixteenth to one fourth of an inch.

A third type is atomic hydrogen arc welding, which is one of the later developments. As yet it has not been used for steel building work for the same reason that the carbon arc has not, namely; its cumbersome apparatus. At present it has found an important field in the welding of thin sheet metal and other fine work which could not otherwise be welded. The process consists essentially of maintaining an arc between two adjustable tungsten electrodes and feeding hydrogen gas to the arc around the electrodes. The hydrogen molecules are broken up into their two atoms by the intense heat, and in recombining outside the arc, liberate an intense welding heat far in excess of that attainable by the gas alone or by the arc alone. The temperature of the atomic hydrogen arc is approximately 4000° centigrade as contrasted with the 3600° Centigrade of the ordinary electric arc and the 3200° centigrade of the oxy-acetylene flame.

RUGBY CHAPEL

Coldly, sadly descends
The autumn evening! The field
Strewn with its dank yellow drifts
Of wither'd leaves, and the elms,
Fade into dimness apace,
Silent;—hardly a shout
From a few boys late at their play!
The lights come out in the street,
In the school room windows; but cold,
Solemn, unlighted, austere,
Through the gathering darkness, arise
The chapel-walls, in whose bound
Thou, my father! art laid.

—M. Arnold.

Metallic-arc welding can be divided into two divisions, automatic welding and hand welding, both of which play a part in building construction. Long built up members such as columns, girders, and beams fabricated in the shop can be economically welded by means of automatic welding heads traveling on tracks. Speed of production is increased and a more uniform result is assured. Hand welding, already described, is used both in the shop and in the field for assembly of the various component parts of the steel framework.

Often the shop work is done by riveting and the field work by welding. This serves to eliminate the noise in connection with building erection, and at the same time permits the use of rivets where they perhaps have an advantage over welding.

It is perhaps opportune here to define a few of the terms used in welding, such as fillet, contact plane, shear plane, normal shear, and parallel shear.

A fillet weld is one at the intersection of two surfaces at right angles to each other in which the material composing the weld has a triangular cross section, its two sides being fused with the surfaces of the members to be joined and its third side being exposed. A fillet can be obtained only when extra metal is added by means of a filler rod or metallic electrode.

A butt weld is one joining the edges of two plates which are in the same or in parellel planes. The plates are usually spaced from one-eighth inch to three-sixteenths inch apart and they must be beveled with a certain minimum angle. The gap is then filled up with weld metal to a height of at least 20% above the surface of the plate. This extra metal above the plane of the surface is called reinforcement.

A contact plane is the plane of contact between welding material and the parent metal of either of the two members being joined.

The shear plane is the plane across the triangular cross section of the fillet perpendicular to the long side of the triangle. This is also termed the throat because it is the shortest distance in the weld.

In bringing the welding art up to its present stage of advancement a great deal of research has been done to determine the various characteristics of the different types of joints nad the best methods of producing them.

The conclusions gained from such research indicates that an electric arc weld is always strong enough to provide a factor of safety of at least four over the allowable value.

In addition to the many tests conducted on small test specimens, there have been a considerable number performed upon complete trusses. For instance, in the case of the erection of the large new manufacturing building of the General Electric Company at West Philadelphia, three 58 foot 6 inch trusses were temporarily erected for testing. They were placed side by side on supports in the same relative position as they were to occupy in the finished building. They were then loaded to twice the designed maximum load and the deflection compared with the calculated value. The measured deflection was 0.89 inches as compared with the cal-

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Chicago's New Outer Drive

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vation, 28.5 feet, except the main trunnion wells and those supporting the wind bracing columns. Long chutes made up of four foot sections of pipe were used to place the concrete in the well. Reinforcing consists of vertical bars and horizontal loops. As each section of the reinforcing was placed, the well was poured, a section twenty to twenty-five feet in height being concreted in each lift. The surface was carefully cleaned off and roughened before each pour. Payment for wells was on a basis of total volume of completed well including reinforcing at $1.29 per cubic foot with $.70 per cubic foot additional for rock excavation.

When starting work on the wells for the North Viaduct, difficulties were experienced due to the water bearing strata of this section. Extremely wet sand is found just below the surface and extends to about 22 feet below datum, a total thickness of about 30 feet. Below this is a layer of soft blue clay about 40 feet thick. The rock surface varies from 88 feet at the river to 100 feet at the slip. The first attempt was to sink a well lined with the usual wood lagging and steel tunnel liners. However, water entered faster than it could be pumped out and necessitated the abandonment of this method. A few other schemes were tried but were unsuccessful.

The final, and successful method provided a rather novel solution to the problem. Large steel cylinders were constructed of 10 gauge steel sheet about three inches larger than the well diameters. (Wells for the North Viaduct vary from four to six feet in diameter). The cylinders were thirty feet long and electrically welded both longitudinally and circumferentially, the circumferential seams being reinforced by a steel band of 2½x⅜" bar welded in place. At the top a 2x2x⅜" L is welded in to stiffen the edge. The well was excavated to a depth of approximately six feet and a square wooden box inserted and carefully centered. Wood guides were nailed to the middle of each side of the box to keep the steel cylinder vertical and centered when it was lowered. The tube was sunk by means of jets until it reached the soft clay layer and then was driven four or five feet into the clay with a steam hammer. When firmly embedded this effectually sealed off the water

The interior of a steel caisson.

and made it possible to dig the well down to rock in the usual manner.

For the first few cylinders driven in this manner a four way jet was used. At present, however, an upward and downward ½ inch opening is working very well. Water issues from the jets in two streams and rises both inside and outside the caisson, lubricating it so that it sinks of its own weight into the sandy strata. Six to eight jets are spaced uniformly around the circumference of the cutting edge and are screwed to a two inch pipe on the inside of the tube. Connection between the upper end of these pipes and a four inch main is made with two inch rubber hose. The main carries water pumped from the lake at the rate of 1000 gallons per minute at 130 lbs. per square inch pressure. The joints of the pipe in the cylinder are all welded except the connection to the jet at the bottom, so that after the cylinder tube has been sunk the pipes may be unscrewed and removed before excavation begins. The jets are recovered when the well is dug. For driving, a steel I beam grillage is placed on top and the hammer applied with the water flowing.

In a few of the wells some difficulty was encountered in using this method. In one or two cases the tube was not sufficient length and water rose under the edge of the cylinder. To seal off the water a set of wood lagging was driven around the circumference flush with the cylinder wall and overlapping the end about a foot. A platform was built across the well somewhat below the bottom of the tube and two feet of concrete poured. When set, the center was cut out and the well continued at a slightly reduced diameter, belling out again to full size when below the seal. Additional reinforcing is placed in the throat.

In some cases boulders prevented sinking the cylinder. In one of the wells where this happened a ring of steel sheeting was driven to the clay entirely around the well and the excavation begun using wood lagging until the boulders had been removed. The caisson was then sunk in the usual way. When the cutting edge approached the bottom of the sheeting the cylinder could no longer be driven. Investigation showed that the sheet piling had all bent in toward the center of the well and stopped further sinking of the cylinder. It was necessary to pull the sheeting before any more work could be done. When a large boulder stopped work on a caisson in one of the other wells before it was more than ½ down a hoist was erected and excavation started from the top (about fifteen feet above the ground) until the boulder was reached and removed so that driving could be continued. In a third case a boulder at the edge of the cylinder pushed the side in until the cutting edges of opposite sides approached within eight inches of each other. When diggers reached the narrow portion it was

burned out and wood lagging driven.

In spite of the occasional difficulties, however, this method has shown itself to be very successful, so much so in fact, that the construction company has applied for a patent on the scheme.

Counterweight Pits

After the subpiers had been poured to grade the clay was excavated for the counterweight pit. About three feet of clay had to be removed. A clamshell bucket was dropped through the bracing and as much of the material taken out as could be reached this way. The pit was then cleaned up and levelled off by the labor gang. A deep drainage ditch leading to a sump at one end of the cofferdam was dug completely around the inside of the sheeting in order to keep the central portion dry. The clay is very wet and sticky, however, and in order to dry up the floor more completely a two inch layer of concrete was poured. This did not count as part of the floor slab but acted merely as a temporary platform on which to work.

The counterweight pits for the river bridge are 92 feet 6 inches by 56 feet by 30 feet deep, inside. Elevation of the top of the floor is 23.5 feet. The floor of the pit is a 5 foot 6 inch concrete slab with two way reinforcing top and bottom. To make sure that it would be water tight the entire floor was poured in one piece, a total volume of over 1800 cubic yards for each pit. At the rate of about two to two and one half minutes per batch from a one yard mixer, this required about seventy hours of continuous pouring. The supports for the cofferdam bracing were all cut out before the pour started and replaced with plank blocking. When the concrete reached a block it was removed until the surface had been finished and set slightly. The bracing was then blocked directly on the floor surface. A slight settling of the cofferdam was noticed due to this temporary lack of support. Large hoppers and chutes were used, placed at intervals across the entire width of the pit, and not over four batches were placed in each chute before the adjacent one was poured. The chutes were filled in order across the width of the pit then moved forward with the derrick and the process repeated so that at no point would the concrete have time to set before a fresh batch was placed. A three-quarter inch mortar finish was used. The concrete was carefully tamped and spaded around the reinforcing, mechanical vibrators being used to insure a dense structure.

When the floor had been poured, forms for the walls were begun, the lower brace struts being cut out temporarily. The walls were then poured up to the bottom of the second tier, the first set, which had been removed, braced firmly against the wall section, and the second set cut out. The wall was then poured up to the bottom of the third set and the operation repeated. There were, therefore, four horizontal construction joints in the wall. Each joint was sealed with a double key and a set of corrugated copper strips set on edge and overlapping at the ends. The surface was carefully roughened and cleaned up before each pour.

The Men Of Old

I know not that the men of old
Were better than men now,
Of heart more kind, of hand more bold,
Of more ingenuous brow:
I heed not those who pine for force
Aghost of time to raise,
As if they thus could check the course
Of these appointed days.
Still it is true, and over true,
That I delight to close
This book of life self-wise and new,
And let my thoughts repose
On all that humble happiness,
The world has since foregone,—
The daylight of contentedness
That on those faces shone.
With rights, tho' not too closely scanned,
Enjoyed, as far as known,—
With will by no reverse unmanned,—
With pulse of even tone,—
They from today and from tonight
Expect nothing more,
Than yesterday and yesternight
Had proffered them before.

—*Lord Houghton.*

Concrete Control and Inspection

The specifications for the Chicago River Bridge required a constant water cement ratio of 0.9 for class I concrete, to be used for subpiers, and a ratio of 0.8 for class II concrete to be used where additional strength qualities were desired. Slump should not exceed four inches, a stiffer mix than customary being possible because of the massive character of the work and the large size and spacing of the reinforcing bars. The composition of the mix was then determined by the field engineer to meet these conditions, the actual proportions varying of course with the quality and grading of the aggregates available. The inspection of the concrete used was rigid and continuous, both material and final product being subject to careful supervision. A group of test cylinders were made and tested for every portion of the work to make sure the required strength was attained.

The sand being used is lake sand from the Indiana region. The specifications call for the fine aggregate to be "clean, sharp, durable and free from dust, soft particles, organic and other deleterious matter." It was noted that the sand, while somewhat finer than permitted, was very well graded and exceptionally clean. Its use was allowed on this basis, the results of the test cylinders showing that this departure was well warranted. The moisture content of the sand as delivered was quite high but after remaining in the storage pile the percent water dropped to about four percent by weight and varied little from that figure thereafter. In spite of this fact a continuous check of moisture content was made throughout a pour and in case any variation did appear the proportions were changed to compensate. The dry rodded weight of the sand was 110.5 pounds per cubic foot.

The coarse aggregate being used is gravel from the Lockport region. The requirement for coarse aggregates states that it shall be "gravel or crushed limestone of the hardest and best quality, free from dust, organic and other deleterious matter; ranging in size from fine to coarse." "Gravel if used shall be washed and screened to remove sand." The water content of the gravel averaged about one percent though the material was very wet when delivered. The weight per cubic foot is 100 pounds with forty-one percent voids. It was found that while the surface of a

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The Modern Power Shovel

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his yards near the center of town. Between this and his destination lay seven viaducts. At each of these he was forced to run the shovel off the trailer and pull under the elevation with its own power and then up onto the trailer again. At this rate he spent nearly a day traveling twelve miles.

Whenever a steam shovel is shipped by rail it must be dismantled by taking the cab off the truck. Gas shovels ship as a unit without any dismantling. The clearance height of the gasoline shovel is seldom more than twelve feet while that of the steam is fifteen to twenty feet. Gasoline for power is most successful as applied to the shovel because it is convenient to handle, economical, and has become so universally used, thanks to the automobile, that it can be obtained everywhere. The motors are low-speed, six cylinder, four cycle types, designed as far as possible for flexibility in power development. When the demand is too great for the motor it will stall, because at low speeds the torque developed by a gasoline engine falls off considerably. This may have its attendant disadvantages, but, as a general conclusion, it is better to have the engine stop than to have some part of the shovel break. The torque drop off for the Diesel engine is not so rapid for low speeds, and for this reason the interesting condition of "too much power" is sometimes found. The Diesel type is useful where fuel costs are high and where longer life is necessary. These advantages are offset by the greater expense of the initial investment.

Electricity is used where the installation is relatively permanent and the conditions to be met with are uniform. Long distance traveling under its own power is impossible with an electrically powered shovel. One finds electricity replacing steam in quarries, gravel pits, etc. The electric motor for power is quiet, smooth, and economical to operate. Obviously, the difficulty is in getting a reliable source of current near the shovel, and for this reason the general contractor who must run up against all kinds of conditions and cover a large territory does not favor the electric shovel. The modern shovel involves many refinements of design which make for strength, economy, and ease of control.

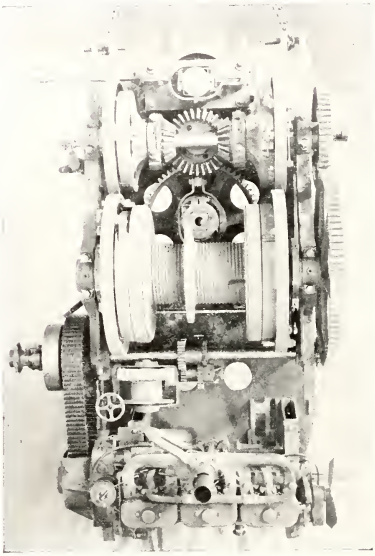

Fig. 2. Above is shown the complete deck of a power shovel.

In employing gasoline we have seen that there must be a centrally located engine with clutches to regulate and distribute the power. Four friction clutches can be seen on the modern machine, shown in Fig. 2. There is one each for the hoist and crowd mechanism, and two for reversing either the travel or the swing. They use a band similar to a brake band to clutch the drum and transmit the power.

About crowd mechanism there is much controversy and unnumbered possibilities. Essentially there must be some means of applying a force lengthwise down the dipper handle. This is usually accomplished by a rack on the underside and a pinion which drives the rack. This shaft on which the pinion is keyed is known as the shipper shaft. The rack is kept in mesh by a saddle arrangement over the dipper handle. (See Fig. 1).

When only one engine is used some means must be found to convey the power to this shipper shaft. A chain, whose lower sprocket is concentric with the boom pivots, can be used. This gives a positive drive mechanism. Another solution is the wire rope crowd. Pull at one end of a cable and all parts of it including the opposite end will be under the same tension. In the wire rope crowd, the cable which hoists the bucket is run down to a drum on the shipper shaft, where it is dead-ended. When a force is put on this cable the rotation of the drum will drive the dipper handle forward. The harder the pull the more force the drum receives. The ratio of the diameter of the drum to that of the pinion on its handle makes a differential which multiplies power.

Another rope is wound on this drum in the opposite direction from that of the hoist rope. It is connected to a drum on the main shaft of the hoisting apparatus and is under separate control of the operator, by means of a clutch and brake. (See Fig. 1). For a motion known as "racking in," where the shovel is pulled and pushed in horizontal directions this rope is employed. Force on the "pull back rope" gives a motion that is horizontal, modified by a slight vertical motion.

When the bucket is being lowered for the next dig the operator releases the clutch on the hoist drum, which allows the hoist crowd rope to run out. At the same time he engages the clutch on the pullback drum, with the result that the bucket goes down to the bottom under its own weight and at the same time is pulled up close to the cab ready for another of its powerful scoops.

This system and its many modifications has the advantage of be-

ing quietly smooth and almost automatic.

There are two possibilities in the design of booms in modern practice; the so-called, outside dipper handle and the inside dipper handle, which means that the boom is solid with two handles back from the bucket, or that only one handle extends back and that it runs through a space cut from its middle lengthwise. The shovel illustrated is an inside handle design. The boom is usually of oak and steel construction. The oak serves as "filler" between two steel channels keeping them at a distance from the neutral axis where their strength is greater. It might be considered to function the same as the web in an "I" beam. The narrow steel web is about equivalent in strength to the heavy oak timber but the oak has the advantage of being fibrous and therefore it will absorb shock and will 'whip" back into shape after deformation stress. Bolts extend through the channels and oak. They are used to eliminate the play after the boom is used for some time. Booms without this feature have been known to crystalize and lose their strength at the joints.

One thing which strikes the mind of the observer of the power shovel is the traction obtainable by the crawler-type trucks. Any one who has ever witnessed a war thriller knows something about their adaptability on tanks for steep climbs over soft surfaces. Standard sizes for the width of the treads vary from 22 inches to 28 inches. The length is sufficient to lower the pressure to magniture which will carry the shovel on average surfaces. For very soft floors the operator uses a "matting" made of planks. Traction enough is obtainable to enable the shovel to leave the excavation on a steep incline, which factor is an important one in reducing costs.

The science of metallurgy has been given a full play in the contributions to shovel design. Alloyed steels are used wherever advantage warrants. The teeth and the bucket front, which must bear the brunt of the attack are made of manganese steel which is hard and tough. These properties make for strength and resistence to abrasion. The teeth are so designed that they are easily replaceable, in slots provided for them on the bucket front. Manganese steel such as used here is so tough that the most modern methods of cutting were too slow for production. Cutting of hardened steel as done in the shop is comparatively crude; band saws and circular saws are the only methods known. (Circular saws mentioned here are not to be confused with the circular cutter used to cut structural shapes which are for softer grades.)

The idea was conceived of using an acetylene torch mounted on a frame which moved in the desired pattern of the teeth. This method is a bit wasteful of the material, but the flame from the torch makes the edges tougher and better able to withstand abrasion..

In closing, a word about the life of a shovel might be appropriate. U. S. government statistics show that on the average they last from about four to six years. And in this time, how many scars they have left on the face of the earth no one knows!

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Safeguarding the Conflagration Hazard

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thus eliminating the main objection to metal shutters and doors. The characteristics, melting and softening of any glass, whether it be wired or not, when exposed to high temperatures can be prevented when water is sprayed on it by open sprinklers. The efficiency of wire glass and shutters is increased nearly one hundred percent by the proper installation of approved open-head sprinklers. This is well illustrated by an account of the Utica conflagration in 1905. The Utica manual training school was equipped with only open sprinkler window protection. Fire completely destroyed a department store at an average distance of 25 feet from the school but not one of the twelve windows protected by six open sprinklers was even as much as cracked by the fire. The opinion was that the sprinklers saved the school building from destruction by fire. It was impossible to install any sort of shutters on the windows because of the smallness of the piers between them.

In the elimination of the conflagration hazard prevalent only too often in every city in this country, the fire protection engineer has done considerable by supplying the needed devices and equipment. Now it remains for him to convince property owners and construction engineers of the necessity to employ such devices in the construction of building structures.

Different conditions of construction and exposure necessarily call for the use of varied types of exposure barriers. The most desirable conditions are where solid brick or concrete walls are used and where window openings are properly designed with metal casings and wired glass, equipped with metal shutters.

It is certain that unless greater care be taken in building construction this ever prevalent hazard cannot be eliminated. The use of even the poorest forms of protection would necessarily improve exposure conditions and help to safeguard life and property from such perilous conditions as have been encountered in our history.

The Canal Era In Pennsylvania

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Hollidaysburg was at the foot of the main ridge of the Allegheny Mountains. In the next 36 miles which separated the terminals of the Eastern and Western Divisions of the canal, the gradient rose 1400 feet above the Juniata, to fall 1200 feet to the headwaters of the Conemaugh, tributary of the Ohio. This barrier was overcome by a system which was the marvel of its age: The Allegheny Portage Railroad. Visitors from all over the world came to wonder at its boldness and write about it in grandiloquent terms. David Stevenson, the famed English engineer, described it as "the boldest and most difficult project, with which only the Mont Cenis Highway could compare." Charles Dickens in his "American Travels" devotes several pages to its thrills.

At Johnstown the canal was resumed along the Conemaugh. At Freeport it crossed the Allegheny River on a high wooden aqueduct, thence following this river to a point opposite Pittsburgh. Here Roebling, who was later to build the Brooklyn Bridge, spanned the river with a cable-suspension acqueduct. This section was 104 miles long and had 66 locks.

The Canal and Portage Railroad were opened for business in 1834. Traffic was heavy for many years. Philadelphia prospered. Pittsburgh boomed as a great manufacturing and steamboat city. Crude blast furnaces appeared at every ore bank; the forest disappeared and the land was plowed. With such encouragement, the state extented the State Works in all directions, until in 1840 it owned 608 miles of canal and 118 miles of railroad. In addition there was some 250 miles of privately owned canal in the state. But the system became a football of Pennsylvania politics; and an expensive one. In spite of the money lavished on the system the "Pennsylvania Public Works" could only carry one-fourth of the Erie Canal's traffic. The slowness of the inclines, the necessity of 'breaking bulk' and four months of winter were tremendous handicaps. Baltimore's "B. & O. R. R." was threatening to soon divert traffic to their all-rail, all-year route.

In 1847 the people authorized the governor to lease the Philadephia-Columbia R. R. to a corporation who would also be allowed to build a railway parallel to the Main Line Canal. So began the Pennsylvania Railroad and so perished the Main Line Canal of neglect after twenty years of service. The entire Main Line, canal, railroad, and portage, together with much valuable terminal property, costing the state 15 millions was sold to the railroad company for 7½ millions. Many of the branch canals were operated for some years moving anthracite coal to seaboard until the flood of 1889 damaged them beyond repair.

By 1850 canal building was at an end; the railroads had won the field. None of the canals, save the Erie, had begun to repay in tolls the interest on the cost of construction. The states which had entered so eagerly on the canal program were left with immense debts which wrecked their credit for two decades, and in several cases led to repudiation. Yet we cannot criticize these old time promoters and builders: theirs was a transition period between the stage-coach and the steam train. They filled the insistent demand for better transportation as best they knew how. After all, nothing worse happened to their canals than is happening today to the elecrite interurbans, and perhaps to the branch railways.

THE BLIND BOY

O say what is that thing called Light,
Which I must ne'er enjoy;
What are the blessings of the sight,
O tell your poor blind boy!

You talk of wonderous things you see,
You say the sun shines bright;
I feel him warm, but how can he
Or make it day or night?

My day or night myself I make
Whene'er I sleep or play;
And could I ever keep awake
With me 'twere always day.

When heavy sighs I often hear
You mourn my hapless woe;
But sure with patience I can bear
A loss I ne'er can know.

Then let not what I cannot have
My cheer of mind destroy:

—*C. Cibber*

Chicago's New Outer Drive

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pile of sand or gravel is rather dry the material tends to increase in moisture content as it is used. It was necessary to keep a careful check of moisture in the aggregate throughout a pour in order to avoid variation of the water cement ratio.

A water cement ratio of 0.9, as used for Class I concrete, means 6¾ gallons of water per sack of cement. A typical mix on this basis would be, for one batch,

6 bags of cement.
1610 lbs. of sand, weighed dry.
2030 lbs. of stone, weighed dry.
40½ gals. of water.

A number of test cylinders were cast at every stage of the work and at a number of intervals throughout a pour. Strength values indicated the correctness of the proportioning by being well above the minimum required in every case. For the mix outlined above, water cement ratio 0.9, the strength values for a 6 x 12 cylinder were:—

At 7 days—2653 lbs. per sq.in.
" 14 days—3148 lbs. per sq.in.
" 28 days—3661 lbs. per sq.in.

Special precautions are to be taken in cold weather, both as to heating of materials and placed concrete and in strengthening the mix. The initial temperature of the concrete after being placed must be 80 degrees Farenheit and the surrounding air must be kept at least 60 degrees Fahrenheit for seven days. This is done by the use of salmanders and tarpaulins, though no concrete has been poured this year in weather cold enough to warrant these precautions.

Arc Welding In Steel Construction

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culated value of 0.97 inches. This close agreement between the two values shows that the same theory of structures used for riveted structures can be employed for welded design with equal safety.

The fact that welding is no longer in the experimental stage, is evidenced by the uniformity of results obtained in the large number of tests mentioned above. These tests were performed by a great number of welders working in a routine manner so that the tests are a true index of the strength to be expected on ordinary building construction work. Welding can now be assigned to a definite place in the structural steel industry.

Professor Frank P. McKibben of the General Electric Company has prepared a set of specifications which have been used in almost identical form on six recently constructed buildings. Contained therein is the set of qualification tests which welders should be required to pass before being permitted to work on a building. The test pieces are shown in the accompanying drawings. The tests are as follows:

Tap Welds "L": Welders may be required to weld two or four sample lap joints each consisting of two ½x6x8 inch plates clamped one on the other with an offset of ½ inch on the six inch side. A full ½ inch fillet is then made along one edge. Upon cooling, the specimen shall be torn apart by wedging at the unwelded six inch edges and the fractured metal examined for proper fusion with both plates, for density and texture of weld metal, for good penetration into the right-angle corner of the fillet, and for freedom from gas holes and other defects.

Butt Welds "B": Two specimens each consisting of two 9x½x12 inch pieces should be butt welded with a double-joint as shown, one in the vertical position, the other horizontal. Each sample plate shall be ground or machined so that the joint is reduced to the thickness of the plate. Standard 2 inch width specimens are then cut from these sample plates and tested in tension. The average tensile strength of the samples tested shall not be less than 45,000 pounds per square inch and the lowest shall be not less than 40,000 pounds per square inch.

Fillet Welds "F": Each welder should be requested to make at least two sample test pieces as shown at "F". Each specimen shall consist of two main plates 4x1x12 inches placed in line with a ½ inch space between their ends. These plates shall be covered by two 3x¾x6½ inch splice plates welded by eight 4x½x⅜ inch fillet welds as shown. The specimens are to be tested in tension to determine the shearing strength of the fillet welds, which should average 11,700 pounds per linear inch of fillet, and should not be lower than the minimum value of 10,100 pounds per inch.

There are several advantages that welding has over riveting. Chief among these is the elimination of noise, which in these days of crowded cities is of paramount importance. Another important advantage is the saving in cost. In the design of trusses no allowance need be made for rivet holes in tension members; consequently, their cross sections may have a smaller area. In the fabrication of plate girders web stiffeners can be made of flat bars welded with their edges against the web, thus eliminating the leg of the angle lying next to the web which does little or no good in the riveted construction. Gusset plates are eliminated again lessening the weight of steel. Other advantages worth mentioning are these: Erorrs are easily corrected. It is much easier to melt a fillet away than it is to remove a row of rivets. A stiffer construction is much more rigid than a riveted one, because rivets can not always be made to fit perfectly tight. The finished work is neater in appearance and is easier to paint than riveted work. The accident hazard due to falling rivets is eliminated. Additions can be made to old buildings very simply. Members may be strengthened without a great deal of trouble. Arc welding recently proved its worth in the strengthening of an important railroad bridge on the main line of the Erie Railroad between New York and Marion, Ohio. As part of an extensive program many bridges were being reinforced to permit the use of heavier locomotives. Many of these bridges, which were of the plate girder type, were reinforced by cutting out flange rivets, adding additional coverplates, and reriveting. Inasmuch as this work was done under traffic, temporary falsework was necessary to support the girders while the work was being done. It was also necessary to disturb the track in order to place new coverplates on the top flanges, and as this had to be done between train movements, it was very difficult. However on one bridge, located in Akron, the use of falsework was impracticable because of the presence of other important tracks, telegraph lines, and a canal under the bridge. Here, the use of arc welding saved the day, because it eliminated the necessity for falsework and for disturbing the tracks during progress of the work. The bridge consists of two spans each approximately 100 feet long, one built in 1903 and the other in 1911. To make the bridge safe for larger locomotives 36 square inches of metal had to be added to the flange of the older span and 23 square inches to the newer one. Plates having holes large enough to go over the rivet heads were welded on first; then solid plates were welded over them, eliminating entirely the necessity for removing the old rivets or disturbing the structure in any way. The total amount of steel added to these two bridges was 63,000 pounds. This is merely an example of the many advnatages of arc welding.

In Memoriam

A child's a plaything for an hour;
Its pretty tricks we try

For that or for a longer space,—
Then tire, and lay it by.

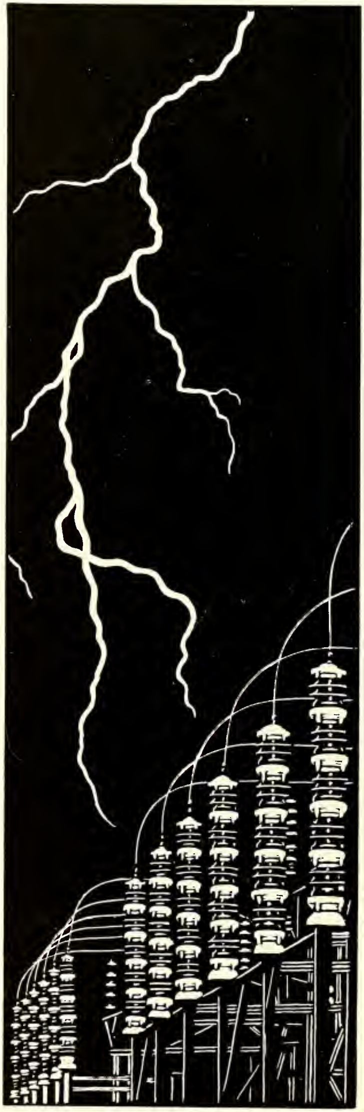
But I knew one that to itself
All seasons could control;

That would have mock'd the sense of pain
Out of a grieved soul.

Thou straggler into loving arms,
Young climber up of knees,

When I forget thy thousand ways
Then life and all shall cease!

—*M. Lamb.*



The ARMOUR ENGINEER

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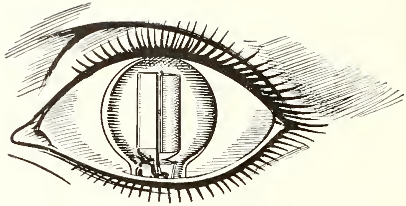
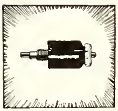


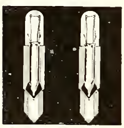
One eye that sees better than two



Heat coils act as tiny circuit breakers, protecting delicate and sensitive equipment from effects of stray currents.

Makers of telephone equipment cannot rely on their eyes in testing a certain type of coil used by the million in central offices. For greater accuracy they utilize the "electric eye" or photoelectric cell. At Western Electric this uncanny piece of apparatus "stares" all day long without fatigue recording galvanometer readings. ℂ It forms a vital part of a machine for automatically separating perfect from imperfect coils. Its use is typical of the way this organization puts science to practical advantage. ℂ Here is no blind following of tradition. And yet new methods must prove themselves worthy—must be tested as carefully and as thoroughly as the telephones and telephone equipment manufactured for the Bell System.

One heat coil every second—tested by the "electric eye" at Western Electric.



The human eye can detect no difference between these switchboard lamps but the "electric eye" can and does.

Western Electric

Manufacturers . . . Purchasers . . . Distributors

SINCE 1882 FOR  THE BELL SYSTEM

THE ARMOUR ENGINEER

Published Quarterly by the College of Engineering

ARMOUR INSTITUTE OF TECHNOLOGY

Volume XXIII March, 1932 Number 3

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The Chicago Art Institute—Home Of The Armour Architectural School.

The Armour Engineer

Volume XXIII — March, 1932 — Number 3

Detonation Sound Evaluation And Test Data of Multiple Cylinder Engines

By Daniel Roesch

Professor of Automotive Engineering

DETONATION in internal combustion engines involves a sound increase as well as pressure and temperature increases. Test methods involving the detection of incipient knock or the adjustment of some engine variable to a predetermined knock intensity are usually conducted by using the human ear for estimating the knock sound-intensity. Instrumentation would obviously be desirable to avoid the personal factor and to permit definite specification of the knock intensity in numerical values.

This discussion will show an evaluation of internal combustion engine noises with particular reference to detonation. The results are obviously fragmentary when the potential studies are considered and are primarily to be considered as indicating the possibilities although specific data is submitted.

Other methods of obtaining an index to the degree of detonation which are favorably considered by students of detonation are the Bouncing Pin which measures pressure and the Spark-Plug-Gasket type thermocouple which measures temperature. The field appears to be well covered by Temperature, Pressure and Sound Inspections.

Some time ago the Outboard Motor Manufactures Trade Association desired tests which would show the relative noise intensities caused by the exhausts of various Outboard Marine Engines. The instrument used for this work was especially designed by the C. F. Burgess Laboratories, Incorporated, of Madison, Wisconsin, for the Outboard Motor Association and has been successfully used for the purposes intended. The Outboard Motor Association kindly permitted the writer as custodian of the instrument, to use it for study of detonation noises. Its adaptability was considered better than various other instruments which had been used at the A. I. T. Laboratories up to that time.

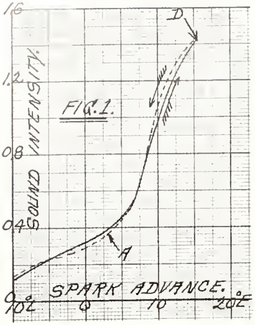
Tests were made upon various multiple cylinder engines which were used for anti-knock test work with evident response to the detonation noises under specific operating conditions.

The instrument includes a magnetophone pick-up which generates an alternating current proportional to the impressed sound wave. This is amplified by vacuum tubes with the output energizing the heating element of a vacuum thermocouple. The thermocouple generates a direct current which is proportional to the mean square of the A. C. current impressed upon it. The D. C. so produced is measured by a galvanometer whose indication is therefore proportional to the mean square of the amplitude of the sound waves. Since the physical intensity of sound is proportional to the square of the amplitude of the waves, the reading of the galvanometer is directly proportional to the physical intensity of the sound waves.

The vox is defined as a sound of such intensity that the threshold of audibility has been reached. Increase the sound and it can be heard—decrease the sound and it is inaudible. The vox is the physical unit of sound or amount of sound energy just audible to the human ear. It may be expressed in ergs per sq. cm. per second and apparently there is no available standard at the present time.

Decibel is a unit developed by the Bell Telephone Laboratories for acoustical instruments. This is the same as the older unit called T. U. for Transmission Unit. The smallest increment that could be distinguished as a gain or decrease in loudness for an average ear was found to be 1/10 of the logarithmic value. This was subsequently called a decibel and is expressed as 10 log 10 (physical units)=decibels.

The decibels are defined as the unit of audibility. The relation between vox and decibels is as follows:—The audibility of sound in decibels may be determined by



taking ten times the logarithm to the base 10 of the number of vox. One vox has an audibility of zero. Ten vox have an audibility of 10 and 100 vox have an audibility of 20, etc. The difference in two sound intensities I1 and I2 may then be expressed as I1-I2 or the difference in decibels will be

$$10 \text{ Log } I_1 - 10 \text{ Log } I_2$$

or

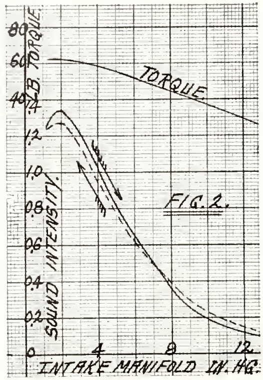
$$10 \text{ Log } I_1 \div I_2$$

In other words the difference in audibility will be 10 times the logarithm to the base 10 of the ratio of the two sound intensities.

The erg per sq. cm. per second is a small power unit, the magnitude of which can be better appreciated by correlative relations. The erg is a dyne-cm (work unit) and the dyne is 1/981 gram (force unit) or approximately one one-millionth of an atmosphere. Ten million ergs per second equal one watt.

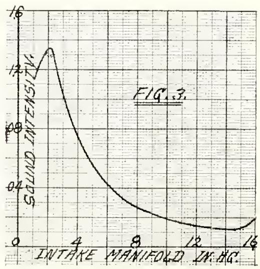
An instrument of interest in studying these relations is a sound pressure indicator having one division of its scale equal to the pressure of one-fourth of a dyne. The dyne is approximately one one-millioneth of an atmosphere. This is known as the Sound Meter described in the Journal of the Franklin Institute, Vol. 208, No. 3, September 1929, by Dr. B. E. Eisenhour of the Riverbank Laboratories.

The instrument as used for Outboard Motor Exhaust Noise Measurements was fitted with an exponential horn to increase the readings. When used for engine work a rubber noise-conveying tube has been used as well as a direct opening to the magnetophone and also by conveyance



through metal. By use of the rubber hose a search of the engine could be made with concentration upon some local spot of particular interest. Wave interference may become very troublesome with this method and localization is difficult because of good metal conveyance. The instrument is provided with a gain control acting in a similar manner to a stepped shunt for electrical current measurements. The galvanometer scale is 3½ inches long with 50 even divisions. Seven graded multiplying taps arranged on a dial switch, permit the convenient adjustment to give multiplying factors up to 516 or an equivalent scale length of about 150 feet with 25,000 divisions. The instrument is provided with A and B battery voltmeters and an A. C. voltmeter used for calibration directly from a 110 volt A. C. lighting circuit.

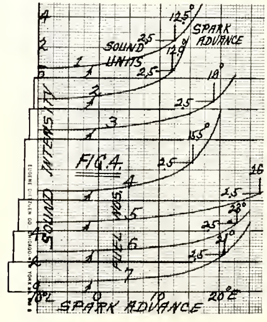
In most of the tests with the Outboard Instrument the value of a division on the galvanometer scale (0.07 inches) was approximately 0.025 sound intensity units. The needle was dead bent for most work and readings were readily made 1/5 of a scale division. Slight drifts in the sound intensity were followed by the needle even before the ear detected the change. Transient noises must be excluded particularly, when the machine is used with an open ear. A gum hose connecting the magnetophone to the source of noise reduced these effects but did not eliminate them and besides wave interference and absorption are potential difficulties.



Later the Burgess Company furnished an Acoustimeter with a built-in filter arranged so that, either all frequencies could be accepted or only those over 2000 cycles per second. This instrument was also arranged to be used in conjunction with a peak-pass filter or frequency analyzer designed to select various peaks of the sound which was being picked up. A magnetic pick-up device was metallically connected to the engine in most cases, and seemed to present less difficulties with interference than airborne connections.

Test results showing performance of a Hupp four-cylinder engine in the Automotive Laboratory of the Armour Institute of Technology are shown on the accompanying diagrams and memorandum. These include both the variable throttle and the variable spark advance methods of testing.

Figure No. 1, shows results of an anti-knock test of a fuel while using the spark-advance method with a Hupp four-cylinder engine operating at 1000 r.p.m. and 5.8



to 1 volume ratio. Observations were made with increasing and decreasing spark advance. The general engine noises are indicated by the portion of the curve between 10 late and 3 early. Incipient knock occurs at point A and severe detonation at D. These values correspond to those used for specifying knock intensities at A.I.T. Laboratories as A, B, D, and C. Fuels having other anti-knock values will be disposed to the right or left of the line A-D with approximately a uniform line of constant noise on the left of point A for all fuels. In some subsequent tests we have found indications that the slope and also the position of the section of the curve to the left of A might indicate variations of general engine noises while using various fuels.

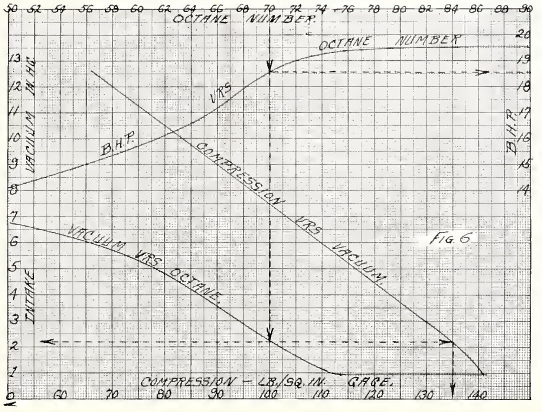


Figure No. 2, shows results of an anti-knock test of a fuel while using the variable throttle and fixed spark method of testing. The same engine was used in tests shown on Figure No. 1. The spark advance was 10° early. Detonation in various degrees occurred with diminishing throttle until 9 to 10 inches of mercury depression was reached. The points to the right of this load represent engine noises and in some cases of extremely light load showed increasing values. This is attributed to bearing loads and slapping of parts due to the higher relative values of inertia loads as compared to gas pressures. Considerable irregular burning and possibly some missing may have occurred. The corresponding torque or horsepower at constant speed is also shown on this sheet. The knock evidently disappears at about 40 lb. brake load which may be compared to a maximum brake load of 61 lb. at 21 inch radius. The torque curve is flat for a short interval from wide open throttle (1.1 In. Hg.) to a slightly closed throttle (2.0 In. Hg.). The corresponding interval in the Sound Intensity curve shows an increasing detonation followed by a gradually decreasing knock. These effects may be due to mixture changes in one cylinder or to distribution changes between cylinders. Inspection of the actual compression pressures by means of a balanced diaphragm type indicator failed to show an immediate drop-off as the throttle was closed slightly from a wide open position. This is considered of sufficient importance to warrant the making of a compression vrs. throttle opening curve of every engine being standarized for anti-knock test work. Evidently the baffling action of the butterfly valve combined with the variable velocity and ramming effects near the end of the suction stroke influence these characteristics and have considerable influence on the shape of the initial portion of this curve.

Figure No. 3, shows similar results to Figure No. 2, made three months later on the same engine. The increased noise at 17 inches of Hg. is to be noted and also a fair check on noise evaluation for all points.

Figure No. 4, shows the results of tests on seven fuels by the spark advance method. These are made at 5.8 to 1 volume ratio and represent fuels of the following approximate characteristics:

Fuels No. 1 and 2 were commercial non-premium fuels.

Fuels No. 3 and 7 were commercial premium fuels.

Fuel No. 4 was an aircraft fuel.

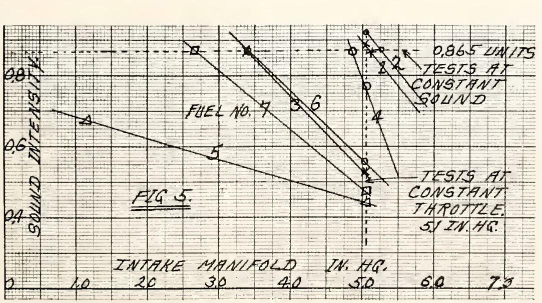
Fuel No. 5 was a cracked fuel.

Fuel No. 6 was a benzol blend.

These fuels range from about 60 to 80 octane number anti-knock rating as designated by the Co-operative Fuel Research Sub-Committee.

The angled loci indicate spark advance for the same knock intensity (2.5 units) for all fuels and the corresponding spark advance necessary to produce this knock intensity.

Figure No. 5, shows a comparison of the anti-knock properties of seven fuels by the part throttle method, using the Burgess Acoustimeter to evaluate the detonation. The test procedure was to operate at 5.1 inches of manifold



(Continued on page 92)

A New Development Plan For Engineering Education

In the past few weeks there have been short notices in the daily press and elsewhere of the inauguration of a reorganization plan for the Institute. There have been indications of vast things in the offing, of new activity, of a greater breadth and wider perspective. In this article, the Development Plan is revealed, and its great significance pointed out.

"ENGINEERING education must provide the way for the solution of problems in the field of social utility as well as the application of scientific principles to specific technical problems. The strictly technical professional activity is comprised in engineering, but it is not the definition of it. What engineering education must have is a guiding philosophy based on a clearer visualization of the place of engineering in modern life."

This quotation, taken from a report which was made some time ago by the Chairman of the Board of Investigation of the Society for the Promotion of Engineering Education, might be a compendium of the results of a study which the Trustees of Armour Institute of Technology have recently completed. The comprehensive scope and exhaustive details of this more recent study have served not only to demonstrate the profundity of the thesis implied in the quotation, but also to disclose the method by which this thesis may be established as a working guide to the future development of a college of engineering. Out of it, indeed, has evolved a plan for development at Armour Institute of Technology which "provides the way for the solution of problems in the field of social utility," — a plan which defines that "guiding philosophy" needed in engineering education.

Two years ago a project of affiliation between Armour Institute and Northwestern University was laid aside, largely because details of the plan could not be worked out to the satisfaction of both institutions. From the discussions, conferences, and exchange of opinions which took place at that time, however, a new idea of the principles and functions of engineering education began to emerge. This idea, in further debate began to assume a more and more definite shape, until it finally moved the Trustees of Armour Institute to undertake the studies which they have just finished. Briefly, the idea is this,—that the day has arrived when the functions, purposes, and development of a college of engineering can no longer be isolated from its service area; that the college has an obligation not only to the student whom it graduates, but also to the life and activity into which the student must fit after graduation, and that both of these obligations will be more effectively fulfilled when the college has set up an efficient mechanism by means of which it may readily adapt its courses and methods to the changing requirements of the area which it serves. And they felt that this necessity for increased usefulness would apply particularly to a college situated in a highly concentrated industrial area like Chicago.

The studies which this idea have prompted, and which have consumed five months of the most detailed research, may be divided into two categories: a survey of engineering and architectural education in America, and an investigation of the needs of the Chicago industrial area in terms of engineering education. The first study included a careful observation of the methods and practices employed at twenty-six index colleges of engineering throughout the country. Entrance requirements, curricula, teaching methods, and administrative organizations were critically examined. The views of prominent educators and leaders of professional societies were sought and ascertained; their counsel will assist in the elimination of practices which have demonstrably outlived their usefulness. Members of the faculty of Armour Institute drew upon their experience to give valuable asisstance in the studies.

In the study of the Chicago area, committees appointed by the Board of Trustees of Armour Institute interviewed professional engineers, architects, and industrial executives, asking for their opinions on the educational requirements of this area. Many large corporations formed committees from their staffs to draft recommendations on educational policies and methods most likely to produce the kind of men needed in their work.

The material from these studies has all been analyzed and correlated, and it serves as the foundation for the development program. The plan provides for every important detail of an educational structure which embraces colleges of science, engineering, and architecture, and the affiliated institutions which combine greatest breadth with utmost usefulness.

Essential characteristics of the new school may be considered in two groups: the internal characteristics, having to do with entrance requirements, curricula, teaching methods, personnel and unit administration; and the external characteristics—placement of graduates, co-operation with graduates as they progress in their profession, industrial relations, and administration of the corporate whole.

Only a few of the broader characteristics of the plan may be outlined in this discussion, but mention here of a few high points in the plan of development may serve to suggest the completeness of its detail, and to express the guiding philosophy that is the

keynote of the entire program.

In the first plan, entrance requirements are to be raised substantially. This will be done progressively, so that no hardship will be worked upon students in the transition period. Nothing is more important to the results of the whole educational process than the personal fitness of the student to proceed. And it is only fair to the applicant that if he is not properly prepared, his energies be diverted into more useful channels. Moreover, entrance requirements will be unified with elimination mechanisms "in course" for students who are found to be defective after they have entered.

In conjunction with the elevation of entrance requirements, and in order to have a large number of fully qualified candidates for admission from which selection can be made, every means of publicity and public education will be used to propagate a wide knowledge of the nature of engineering education, what practice of the profession requires and leads to, and who is best fitted for the career.

All other wholesome means of attracting students will be employed. Sound extra-curricular student activities will be fostered, and will include athletics in the form of intramural games, games which the student will keep up after graduation, and inter-collegiate sports on a healthy scale.

Study of engineering curricula makes it plain that these courses have not always been planned to suit the demands put upon the engineer by his position, opportunities, and responsibilities in after-life. No longer can consideration of an engineer's usefulness and activity be confined within the narrow limits of his purely technical range. Only slightly more than half of the graduate engineers in employment are occupied in work directly relating to the special branch of engineering in which they were educated. And this includes engineers of all ages. As they grow older and assume positions of responsibility, only thirty percent are finally occupied in primarily technical work, and one-third of these are in some form of consulting which ranges over broad technical fields.

"The trouble with most of these boys," said a vice-president of one of Chicago's large public utilities corporations, speaking of the recent chemical engineering graduates now in his employ, "is that they know their jobs almost too well. They know their own work thoroughly, but they don't know anything else. They can do a job, but they can't make a good report of it. And they haven't studied enough economics to know just what position their work occupies in the vast pattern of modern industrial life."

As a matter of fact, most students entering the four-year under-graduate engineering school do not seek to make themselves professional experts in the specialized sense. Most of them are seeking to prepare themselves to fit with advantage into general technological and administrative positions in industry and even commerce. Under these circumstances, curriculum should combine a sound engineering education with a broad humanities perspective. Economics, History, English, Psychology — these should be stressed more than they have been in undergraduate engineering curricula in the past.

So the new school will offer four-year courses more fundamental in character, educating more broadly, and giving greater scope to the fundamental sciences, the fundamental studies, and the humanities by decreasing the scope of the special or professional engineering subjects. The humanities department will be greatly enlarged and fortified.

The manual training functions of shop-practice courses will be abandoned and the courses completely reorganized with distinctly science laboratory concepts and emphasis. In them, research and study in the fundamental processes of cutting, bending, forming, and drawing metals and other stocks, will be stressed in the hope of creating a science for the working of materials.

Running parallel to the engineering departments, a school of science will be established. Great expansion in the field of the basic sciences, particularly recent developments in physics and chemistry, makes establishment of such a school or department necessary. A bachelor's degree will be awarded as in the engineering departments.

Fifth-year courses will be established for both science and engineering students. These courses will afford an intensive education for those seeking to attain a high professional and specialized status in their chosen field. The fifth-year courses will be based on the broad fundamental four-year courses and coordinated with them so as to constitute harmonious, unified, five-year periods of study with easy transition from the undergraduate to the graduate studies. A master of science degree will be awarded for completion of these courses.

Although plans for the school of architecture are considerably more complex and not yet completed, it is likely that architecture, with its heavy demands on both engineering and the fine arts, will be made a five-year course giving a much greater opportunity for education in all activities of the profession.

Then a full graduate school is to be established with well-defined programs of science and engineering research and study for sixth and seventh years. The doctor's degree will be awarded on completion of graduate work.

Another feature of the new school which probably will be most useful to present Armour graduates is the establishment of day and night post-scholastic courses which will be given in some central location in Chicago, or in centrally located points throughout this industrial area. Graduates will turn to these courses as a means of keeping abreast of latest developments in science and engineering.

A permanent faculty committee on educational policy is to be organized, having sub-committees to deal with matters of curriculum and method, graduate and research work, entrance requirements and student activities, and personnel and placement. This committee will have the continual responsibility of studying all these phases of engineering education for the purpose of devising advanced and more effective methods, experimenting with the new methods developed, and making recommendations and installations when new methods are demonstrated as more effective.

A personnel and placement department will be established and extensively developed. It will co-operate with the well organized personnel departments of industries to assist in the proper placement of new graduates. This department will follow and study

(*Continued on page 96*)

Designing The Modern Skyscraper

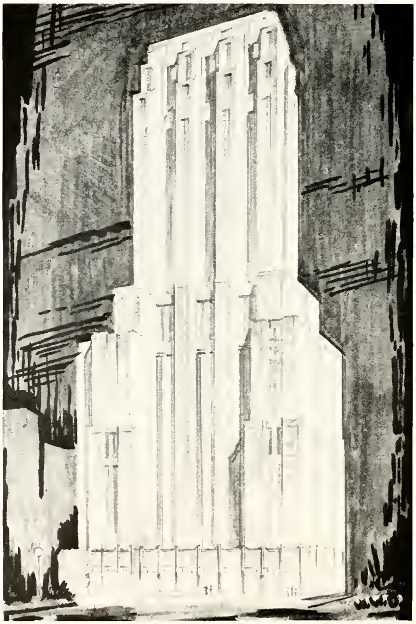
By Wilfred W. Davies, '33

Student in the Department of Architecture

WHEN one stops to realize that for about six thousand years Egypt had only the structural principle of the post and lintel, that Greece followed with the same principle, though with a refinement and a system of proportion, and that Rome introduced the masonry arch, one must also realize that up to fifty years ago these were the only principles, structurally speaking, in our buildings.

Then came steel skeleton construction, now an accepted method over the entire world. It has made possible great height in our buildings, and has increased the rapidity of construction tremendously. This we must admit: that steel and speed are two of the most important factors governing American architecture of the present time.

The real beginning of the skyscraper is not so definite that the index of history can place its finger upon any one date or any single individual as deserving all the honor. That it is distinctly American none will question. About the year 1885 the early type of steel-skeleton construction in Chicago, known as the "Chicago Construction," gained such prominence in this city as to bear its name. The first outstanding iron-skeleton type building in the country was the Home Insurance Building, designed and built by Major W. L. B. Jenney, architect, in 1883-84. This building was a ten-story structure in which the floor loads were carried by Bessemer steel and wrought iron beams attached directly to cast iron columns embedded in self-supporting brick wall piers.



The above is a sketch of the Palmolive Building, one of Chicago's most recent skyscrapers.

With the beginning of lofty building construction three other problems arose, the proper solution of which added greatly to the progress of art. Prior to 1870, arches of four inch brick spanning between the lower flanges of iron I-beams about five feet on centers was the standard so-called "fire-proof" construction. Corrugated metal was sometimes used in place of brick. In 1871, in Chicago and New York, patents were taken out for flat tile arch systems which obviated both of these effects, that is, the exposing of lower flanges, and the objectional ceiling effect. These patents, with slight modifications, are still used in first-class construction. A great saving in weight was effected, also a level ceiling and protection for beam flanges. The patents, taken out at the time of the great Chicago Fire, were doubtless given birth by that great catastrophe, although this same conflagration exhibited many admirable examples of fire-resisting brick and concrete.

After the Home Insurance Building, 1883, Chicago took the lead in skyscraper construction. The Rookery Building, of which Burnham and Root were the architects, was built in 1885-86. It was an eleven story structure and the (*Continued on page 94*)

The Advance of Bacteriological Engineering

By William A. Holland, '32

Student in the Department of Chemical Engineering

BACTERIOLOGY is, as far as sciences go, a comparatively new science, although certain branches of the subject, such as the fermentation processes, can well stand up alongside of many of the so-called "time honored" fields of other scientific endeavor.

There is the general contention among chemical men that bacteriological engineering is but a more or less specialized phase of chemical engineering. Whether this is true or not does not matter fundamentally because the principles involved are basically sound regardless of the category in which they are placed.

Bacteriological engineering, as it is considered today, is the basis of some of our largest industries. First, and probably most important from an industrial viewpoint, is the matter of fermentation, involved in such magnitudinous productions as the manufacture of alcohol, yeast, cheese and milk products, tanning, tannic acid, citric acid, lactic acid, etc. Another large division is in the matter of sterilization of waste products, sewage disposal, etc.

Substances of biological origin are easily decomposed without materially altering the composition or introducing a substance which is difficult to remove. A knowledge of the physiology of bacteria and their relationship to their chemical environment is most important in this respect. For example, it is not a well known fact that liquids or solutions on the alkaline side of neutrality will never decompose, although on the acid side decomposition will take place to a considerable degree.

Of the various fermentation industries, that represented by the manufacture of the many commercial solvents is perhaps the most outstanding example of our modern bacteriological engineering. The technique of the simple sugar and yeast fermentation is, no doubt, somewhat familiar to the reader. This represents what might be called a normal fermentation reaction and yields the basic chemical raw material, ethyl alcohol, which finds innumerable uses in industry as a solvent and chemical reagent. However, the industry has not been satisfied with the "normal" transformation brought about by bacteria, and hence, one of the recent trends, especially among researchers, has been the artificial modification of certain natural fermentation phenomena. One of the earliest and most striking of these has been the "side-tracking" of a normal fermentation involving the production of glycerol by the addition of sulphites to sugar solutions fermenting under the influence of yeast. At one time (during the war) this method was being employed in Germany for the tremendous production of over a million kilograms per month.

The industrial employment of certain bacteria to produce acetone and butyl alcohol from starch mashes or sugar solutions furnishes a more recent example of an artificially modified process. Thus, if acetic acid is added to the cultures, under appropriate conditions, an enhanced yield of acetone is obtained, and amounts to about 80 per cent of that which would be required from the condensation of the ketone and one

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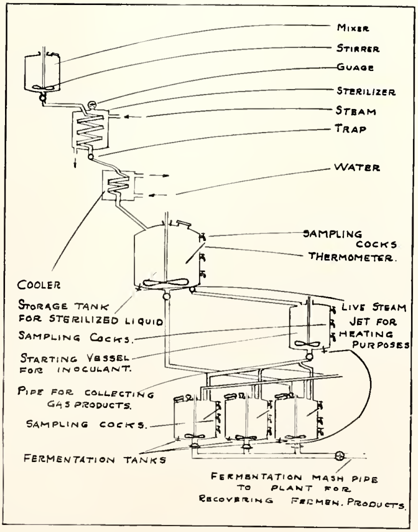


Plant for the production of many types of fermentation products under semi-continuous conditions.

The Supercharging of Gasoline Engines

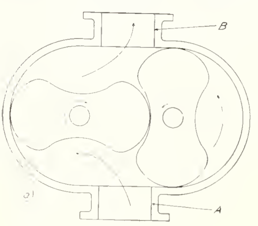
By David L. Cornwell, '32

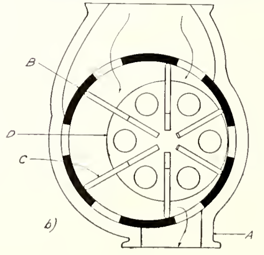
Student in the Department of Mechanical Engineering

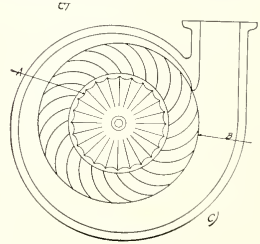
A SUPERCHARGER is a compressor used in conjunction with with the induction system of an internal combustion engine to increase the pressure of the charge in the cylinder at the end of the intake stroke. The purpose of increasing the pressure of the charge is to increase the mean effective pressure in the cylinder.

Internal combustion engines of all types produce work by expanding a gas at high pressure and temperature down to some lower pressure. This expansion is accomplished in the conventional engine by means of a cylinder and piston in a manner similar to that of the reciprocating steam engine. This paper is only concerned with gasoline engines operating on the Beau-de-Rochas four-stroke cycle. In this cycle, the events are as follows: on the forward, or down, stroke of the piston, the intake valve is opened and a charge of air and gasoline is sucked into the cylinder; on the return stroke, the valve having closed, the charge is compressed; at the end of the return stroke, the charge is exploded by an electric spark, and the heat of combustion raises the gas (products of combustion, nitrogen, and excess oxygen) to a high temperature and pressure; on the second forward stroke, the working stroke, the gas is expanded; on the return stroke, the exhaust valve is opened and the burned gases expelled, except for those remaining in the clearance volume. Considering these events, it appears that the work obtained per cycle is primarily dependent on the conditions of pressure and temperature at the beginning of the expansion stroke, the cylinder size being given. These conditions are, in the main, functions of two factors: the compressed pressure of the charge, and the heat available. The compressed pressure of the charge varies with the volumetric compression ratio of the engine and the pressure before compression which may be designated "initial pressure." The heat available is dependent on the weight of fuel-air mixture present. With a given cylinder size, the weight of the charge varies directly with its density. The density, in turn, varies directly with the pressure before compression, the initial pressure. Therefore, by increasing the initial pressure, the work per stroke may be increased. The compressed pressure of the charge is limited by the phenomenon of detonation. When the compressed pressure of the charge reaches this value, it is not advisable to increase the initial pressure for, though the mean effective pressure may increase, the stresses in the engine are greatly increased by the detonation. Under certain conditions, the initial pressure with a natural induction system drops off. It is then profitable to raise it by means of a supercharger up to the point where detonation sets in. One condition under which the initial pressure drops off is with a decrease in atmospheric pressure as in operation of the engine at a high altitude. This condition is common to aircraft engines. Another condition under which the initial pressure drops off is that of high engine speed. The resistances of the carburetor, manifold, and valve passages cause the initial pressure to drop off by a throttling effect if the gas velocities thru them become high enough. This condition is most common in automobile engines but also exists in racing aircraft engines.

Two systems have been used to accomplish the increase of initial pressure. Only one is widely







used. This system is called "forced induction." A compressor is placed in series with the induction system of the engine, either before or after the carburetor, and the entire volume of air or mixture, as the case may be, passes thru the compressor. The other system is termed "supplemented induction." On the suction stroke of the engine, a very rich mixture is drawn into the cylinder. Before the stroke is quite completed, the intake valve is closed and enough air forced into the cylinder thru another valve to bring the pressure up to the desired figure and to provide for the combustion of the excess gasoline.

The history of supercharging goes back quite far in the history of the gasoline engine. Results of practical value were not obtained until an incentive was provided in the Great War. Altitude is an advantage in air fighting. The power of an engine falls off with increasing altitude until equilibrium is reached between the horsepower available and the horsepower required to drive an airplane. The height at which this occurs is called the "ceiling" of the plane. By the use of the supercharger, the ceiling may be greatly raised. Experiments with the use of the supercharger had not progressed far enough by the end of the war to enable any considerable number of aircraft to be so equipped. These experiments have been continued and very remarkable results obtained. In commercial aviation, the supercharger is used to maintain sea level power up to a moderate altitude. About 1923, the supercharger came into use on automobiles of the racing type. The designers of these engines were limited by the racing rules to a given piston displacement. In an effort to increase the horse power output, engine speeds were made very high. This method only went so far, because the horsepower output fell off after a certain speed, due to the great decrease in initial cylinder pressure. The supercharger was applied to remedy this condition. This enabled engine speed to be made very high with the horsepower always increasing with speed. The horsepower output at lower engine speeds was also increased, for initial pressure starts to drop off even at moderate engine speeds. Engine speed is now limited only by the ability of the engine to function mechanically, speeds as great as 8500 r.p.m. having been attained. In 1923, the supercharger was also applied to a regular-production passenger automobile by Mercedes-Benz. Since then, various passenger cars have been equipped with superchargers. The cars are usually of a sporting type.

There are four types of compressors which can be used for supercharging: 1) the piston compressor; 2) the Roots blower; 3) the vane type compressor; and 4) the centrifugal compressor. The first, the piston compressor, is not used because of its bulk and vibration. The second and third types are mostly used for automotive work, while the fourth is widely used on airplane engines.

The Roots blower has been used for aviation work, but is used chiefly on high grade automobiles and European racing cars. The operation of this blower may be explained in conjunction with figure 1, a. The two rotors are driven in opposite directions by means of mating spur gears at the end of the rotor shafts. The sections of these rotors are mathematically designed so that there is always a slight clearance between them. There is also a slight clearance between the rotors and casing. These provisions eliminate rubbing friction. Air enters the blower at A. When the tip of the rotor passes the edge of port B, the gas contained in the pocket formed by the rotor and casing is compressed by a momentary back flow of the compressed gas in B. The remainder of the delivery takes place under constant pressure. This is known as the "hydraulic cycle." This blower will produce pressure at very low speeds. Blowers of this type have been operated at speeds of over 9000 r.p.m. The delivery pressure is on the order of six pounds per square inch gauge. The discharge of the blower is pulsating, but no trouble is occasioned by this ordinarily.

The vane type compressor is made in several different forms. All of them have this in common; the compression, or blowing action, is caused by the rotation of a cylindrical hub, eccentrically placed with relation to the enclosed circular casing, bearing vanes whose tips follow the curvature of the casing. Figure 1, b, illustrates, schematically, the action of the Cozette compressor, the best known of this type. The false rotor, B, and the rotor, D, are driven at the same speed. Air enters thru ports in the false rotor as indicated by the arrows and is discharged after being compressed. The false rotor operates with a small clearance.

(*Continued on page 89*)

Automobile Piston Displ.	Weight	Tires	Performance: Gear Ratio-Acceleration[1]-Maximum[2]			
			1	2	3	4
Bentley 4398 c.c.	——	32.5 x 5.25	11.88-5-30	6.44-6$\frac{4}{5}$-50	4.79-7$\frac{2}{5}$-70	3.53-11$\frac{4}{5}$-92
Bentley-S[3] 4398 c.c.	3700 lb.	33 x 6	9.3-4$\frac{2}{5}$-38	5.7-6$\frac{2}{5}$-58	4.7-7$\frac{4}{5}$-70	3.53-11$\frac{4}{5}$-98
Lagonda 1954 c.c.	2600	31.5 x 4.75	13.2-—-30	8.25-—-50	5.28-—-70	4.2-—-80
Lagonda-S 1954 c.c.	2900	31 x 5.25	13.2-4$\frac{2}{5}$-32	8.25-6-52	5.28-10$\frac{4}{5}$-82	4.2-11$\frac{3}{5}$-88
Lea-Francis-S 1496 c.c.	——	27 x 4.4	14.23-—-—	8.47-5-50	5.56-8-68	4.27-14-85
Mercedes-S 6245 c.c.	3900	33 x 5	11.5-3-—	7-3$\frac{4}{5}$-—	4.5-6$\frac{2}{5}$-—	3-10-95

1- Time of Acceleration - 10 to 30 m.p.h. - seconds 3- Supercharged
2- Maximum Speed - M.P.H

The above is a tabulation of Test Data on Gasoline Engines.

Engineering News

Distortion - Factor Meter

The maximum output level of amplifiers as determined by the introduction of harmonics is now easily measured, as the result of a development by a large radio corporation of a distortion-factor meter. This meter reads the total harmonic content of an impressed wave directly on a potentiometer dial. The method is entirely visual and may be used in a noisy locality. No calibration is required and the manipulation is simple.

The distortion - factor meter consists of a calibrated potentiometer and a filter. The filter is so designed as to cut off sharply above 400 cycles (the test frequency for which the instrument is designed) and has an absolutely flat characteristic from well below the second harmonic to above the fifteenth harmonic.

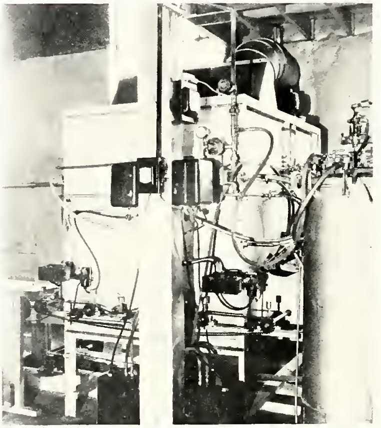
In operation the signal being examined is connected to the input and passed through the filter which entirely suppresses the fundamental. The total harmonic content remains and the deflection caused by it on a meter is observed. The filter is then switched out of circuit and a potentiometer adjusted until the output of the instrument for the fundamental is the same as that previously obtained on the harmonics. When equal deflection is obtained the total harmonic content of the wave is read from the potentiometer dial.

Gear Lubricants

Sulphurized oils and greases especially suitable for high-speed bearings, speed reducers, and other gears, have been recently introduced. The lubricants, which are known as extra pressure lubricants and are available in either oil or grease form, range in viscosity from s. u. 100 sec. at 100 deg. F. to 350 sec. at 210 deg. F. with a pour test for the lower viscosities as low as minus 40 deg. F.

Photoelectric Eye Operates Spray Guns in Priming Lumber

Priming coats of paint can now be applied to lumber with the help of the photoelectric eye, thus protecting the lumber from change in moisture content, infection by fungus growth, etc. Only recently, there has been designed a spray priming equipment using aluminum paint for this purpose.



Courtesy—General Electric.

Photoelectric Equipment for latest type of Lumber Paint Sprayer.

The new equipment operates at a speed of from 60 to 200 lineal feet or more per minute, depending on the speeds of the conveyors feeding lumber to and taking it from the priming machine. The operation is entirely automatic. The priming equipment is in the form of a spray painting booth with apertures through which lumber enters and leaves.

As the lumber leaves the booth, the "flags" are released, allowing the light beams to shine on the photoelectric tubes once more, and stopping the spray until the next board arrives.

The cost of such overall priming ranges from $8 to $10 per thousand cubic feet.

Parking Problem Solved by Vertical Parking Machine

Science has made automobile parking in congested areas as simple as pushing a button. This statement is warranted by the development of the new vertical parking machine.

In actual service this unique tower takes the cars off the street, out of the way of active traffic, and houses 24 or more of them above a ground space only slightly larger than that occupied by a two-car garage.

When this machine is used in a public garage, the call buttons may be located in the cashier's office. As the motorist drives in he is directed toward the parking machine and the attendant pushes a button that opens the door.

The patron drives his car on the cradel, steps out of the inclosure and operates a small hand lever. This gives him a check showing the number of the cradle and the time of parking. Throwing the lever also causes the doors to close and a vacant cradle to come into position at the driveway level behind the doors where it will be ready for the next customer.

Upon returning for his car, the motorist presents his check to the cashier and pays for the storage. The cashier pushes the button corresponding to the number on the check and by the time the customer steps over to the parking machine, his car is there ready to be driven off the cradle. As the car moves away, the doors close automatically. Safety devices make it impossible for the parking machine to operate automatically while the doors are open or while anyone is inside the inclosure.

Just as elevators gave us the vertical transportation that solved the pedestrian problems in the business districts of our cities

Fireproof Wood.

There is no wood that will not burn in the natural state, but Dr. P. G. Hildebrand, the well-known chemist who has experimental laboratories at Springdale, near Pittsburgh, Pennsylvania, has discovered a method of treating any kind of wood so as to make it fireproof, as strong as steel, and as light as aluminum. He can even take chips and other waste pieces of lumber and by the process of cooking the wood into pulp produce materials which can be used in the place of metals, bricks, and asbestos. First, the wood is chipped into small pieces, ground into fiber, then pressed back into lumber of fireproof variety.

Hunting the Atom.

The Bureau of Standards announces the discovery that the nucleus of an atom spins on its axis. Scientists regard it as one of the most notable advances ever made in atomic physics. Almost simultaneously, Dr. Robert J. Van de Graaf, young Princeton physicist, announced through the American Institute of Physics, the development of a new type of electrical generator capable of producing 15,000,000 to 20,000,000 volts of electric current. This voltage, it is believed, may accomplish the breakdown of the atom. The California Monthly, an alumni publication of the University of California, prints that a huge electro-magnet has been installed in the university to be used in an effort to break down the component parts of the atom. This magnet weighs eighty-five tons, being one of the four largest in the world.

by making super skyscrapers possible, so will vertical parking go a long way toward the solution of our worst traffic problem in those areas where further horiozntal expansion has become impossible.

The first commercial installation in the Loop district of Chicago began operation recently and negotiations are under way for a number of other machines in several cities.

The two Chicago machines accommodate 48 automobiles at one time and occupy a ground area only 32 by 24 feet. They are 105 feet high and constructed entirely of steel.

New Development in X-Ray Tube Results in Improved Performance

By substituting a quarter-inch thickness of glass of a special nature in place of the sixty-fourth-inch thickness of the more usual glass, by changing the geometrical design, and by increasing the water-cooling of the target, research engineers have found it possible to increase very considerably the voltage at which an x-ray tube can be operated. By using such a tube rays so power-

Courtesy—General Electric.
Thick Glass X-Ray Tube with Water-Cooled Target.

ful that stereoscopic pictures revealing inner secrets of four-inch steel forgings can be obtained in 15 minutes, instead of requiring hours as did high-voltage tubes of previous designs.

Until this development of the past year, the highest-voltage x-ray tubes available commercially were operated at 200,000 volts. Operation of these thin lime-glass tubes at a higher voltage increased the danger of destruction of the tube as a result of high-voltage surges causing a breakdown of the glass. It was found that a very heavy glass could be used and that, without materially increasing the dimensions of the tube, much higher voltages could be employed.

A Swimming Pump

A novel pump under the name of "swimming pump" has recently been developed. An electric motor with a vertical spindle is mounted in a cylindrical sheet-metal vessel of sufficient volume to float the motor and the centrifugal pump placed outside below the motor. This arrangement has the advantage that it is easily transportable and requires no fixing, as it has merely to be dropped into a pool of water and is ready to work as soon as the flexible cable is connected up. The pump is not always submerged to a sufficient depth, but as the depth does not vary, it works with a minimum lift and with a uniformly high efficiency.

Coal Dust Explosions Drive Motor for Power Plants.

Explosions of coal dust, often the cause of great disasters, have been confined in the cylinder of an internal combustion engine and made to behave so in obedience to the command of the engineer that they give promise of becoming one of the chief power sources of the world. The machine was described at the International Coal Conference. It involves the changing of the ignitionless, crude oil burning or Diesel type of internal combustion engine into one which will use coal dust for fuel.

The new dust motors have been run thousands of hours and are proving exceedingly satisfactory. The motor itself is essentially a Diesel engine with the addition of an auxiliary chamber in which the dust fuel is prepared for admission to the cylinder head where it is compressed and exploded.

Coal pulverized for burning under boilers explodes satisfactorily in the cylinder head, but "Italian Sanzza," a meal made of the residue left from the manufacture of olive oil, and ground-up wood, have operated the motor just as well.

Garage Doors Opened by Automobile's Headlights

The "electric eye" has a new task—a task that puts the "Open Sesame" of "Ali Baba and the Forty Thieves" to shame. Unlike the fairy tale, not a word need be spoken to open the garage

(Continued from page 87)

THE ARMOUR ENGINEER

Published Quarterly by the College of Engineering

ARMOUR INSTITUTE OF TECHNOLOGY

Volume XXIII | March, 1932 | Number 3

Make The Armour Engineer the best technical college publication in the country.

I set before me the statue of a celebrated minister, who said that confidence was a plant of slow growth. But I believe, however gradual may be the growth of confidence, that of credit requires still more time to arrive at maturity.

ARMOUR INTERCOLLEGIATE athletics are expanding to a very noticeable degree during the spring semester of 1932. This is all the more remarkable in that most of the colleges and universities of this section are involved in quite extensive programs of retrenchment as regards their athletic activity.

The annual Indoor Intercolliate Invitational Track Meet, to be held April 2nd, has been greatly expanded to become a Relay Carnival, and with relay events to attract both universities and colleges, bids fair to become one of the important indoor meets of the Central West. The baseball team has become a member of the Northern Intercollegiate Conference, and as such will engage in home-and-home contests with the teams of each of the member colleges. Also, an expanded non-conference schedule with major opponents will be arranged. The swimming team is enjoying a very successful season, and is drawing competition from an ever widening area. Southern Illinois and Indiana colleges and Western Conference universities are to be met in this and following seasons.

The men on these various squads must train constantly in order that our teams may warrant these opportunities at major competition. Much hard work and a vast amount of time is entailed.

Armour will obtain a great deal of needed publicity from its widening athletic activity; more public interest in the Institute will be aroused; general student support will be needed and even demanded in order that these efforts shall not seem wasted and appear only temporary. It is to the schools and to the individual student's direct benefit that the name of Armour be brought and held to the public eye.

A PROMINENT EDUCATOR of our day has said that "Mediocrity is the curse of our civilization." The interpretation is, obviously, that too large a proportion of trained men, and untrained ones too, for that matter, are satisfied to get a fairly good position, if they can, and sit back and relax with the erroneous attitude that their days of intensive study are over. Consequently, they merge into a condition of stagnancy—they become mediocre—and they are content to be just another "cog" in the machine.

College students, particularly those studying the sciences and various professions, have a golden opportunity to train themselves so that they might rise above the common levels of employment. This advantage finds outlet by the time-honored expediency of hard work. It cannot be denied that the intelligent application of hard work will reward a man with just compensation. If a student en-

deavors to develop this trait by constantly doing his best in his studies he will gradually assume the habit and in later life will undoubtedly be a success in his professional field.

The old proverb that says "what is worth doing at all is worth doing well "should always be the guiding light in any endeavor for there can be no doubt that if this principle is followed success is an inevitable result. However, those men of mediocre standing may be trying to do their best but find they cannot get ahead. The reason is probably this. They have stopped studying and have become satisfied with their accumulation of knowledge—knowledge that may even be obsolete when they are ready to apply it. Consequently, other "pluggers" who are benefitting by their own hard work, perhaps at the expense of privation of some material enjoyment, forge ahead to the top of their profession.

There is one definite conclusion that can be reached and relied upon, that hard work can never injure anyone and, in the great majority of cases, will often draw the line between just another job and a prominent executive position.

IT IS BECOMING MORE AND more apparent to those interested in technical education, that it is predestined that tomorrow's industrial and financial leaders will be engineers. The largest corporations of today owe their financial success to engineering improvements. The engineering and financing are so closely related in such organizations that a man with technical training, as well as financial insight, is the man best suited to dictate what should be done in many of the situations that face a large corporation. His greater powers of concentration and administrative ability force him into the foreground of business.

The instilling into our technical graduates of the qualities necessary to fit them for such positions has resulted in major changes in engineering curricula. To date there has been no tendency to turn our technical schools into graduate institutions; the entrance requirements as yet can be met by high school work alone. However, the proportion of college transfers in many technical institutions is increasing rapidly.

A year or two of college work prior to commencement of technical study is a distinct asset when it may be managed. The study of English, Economics, History, Languages, Commerce, Traffic, and other liberal and commerce subjects, before starting the very specialized technical courses is of a very great and real benefit to the individual. He has a much clearer perception of the relative importance of the technical and general studies, and with his more mature mind is able to breast easily the strenuous pace which the others struggle to maintain at great effort. When he is graduated from an engineering course he leaves with a well-rounded professional training, one likely to keep him a lap ahead throughout life. Anent to this it has been said that the competent engineer should know "something about everything, and everything about something."

WITH STARTLING CLARity the words of Dr. Preston Bradley may be recalled at this time. It is to be remembered that at the Armistice Day Address at Armour last year, Dr. Bradley stunned his audience with the assertion that within ten years the United States will have been a participator in another war. And so, with the threatening war clouds present in the far east, the eyes of the younger generation, as well as those of older generations throughout the world, are turned toward the Orient. But perhaps, of those eyes of the younger generation, there are none as important as those of the engineer. It was the engineer who first provided the materials and cut the roads so that man might destroy man, not only his physical being, but his trust in fellowmen, his family ties, his idealism, and his cooperation.

And so, just as the engineer was the indirect instigator of war, so must he be the one to bring destruction to an end, thus paving the way for better understanding between the peoples of the world.

Undoubtedly our generation will be able to do little more than dig the soil that this condition might be strong enough to hold up against jealously, hate, and greed.

And thus, in the ideas of Dr. Bradley, it is for the engineer to bring the world closer together by the use of his learning so that instead of sending worships, troops, and other threats of bloodshed, broken hearts, and ruined land, we have peace; a peace not bred of lengthy documents and misplaced trust, but a peace emanating from good will and friendliness.

THE TRUE OBJECT OF EDUcation is the instilling in the individual of the essentials of technical knowledge, and the developing of his sense of responsibility. The former is usually a matter of form, and in most men, is generally accomplished in time. It is the latter, his sense of responsibility, which is not often brought out as it should be. One of the most common criticisms employers have of recently graduated men is their inability to take the responsibility of seeing a project through to its completion.

Our present system of higher education is very much to blame for this deplorable condition. Modern teaching methods encourage the shifting of responsibility and the procrastination which will not fit into the present day picture of a good employee.

The new vogue among educators, one that is ever increasing in popularity, is, "Let the student seek for his education instead of forcing it on him." The University of Chicago, with its newly installed educational system, a close counterpart of the methods followed in European educational centers for many years, is attempting to instill this new thought into active use. It will undoubtedly be a difficult program at the start, as it is absurd to expect that students who have been brought up under present-day methods will suddenly turn over a new leaf and resolve to work in a course where no definite dated routine is scheduled.

Responsibility is hard to cultivate at college; it is against the atittude of the crowd. However, until our colleges can produce men who will capably fill responsible jobs upon graduation, industry can rightly express dissatisfaction with her recently graduated recruits.

College Notes

W. S. E.

Col. Henry A. Allen, of the firm of Allen & Vagtborg, consulting engineers, spoke before the Armour branch on Friday morning, February 5. His talk dealt with the adaption of design to locality, emphasizing the great effect costs had upon the determination of the actual design. He cited numerous examples of the above where freight or handling costs became excessive.

He described a personal experience of design in the Hawaiian Islands. The problem consisted of water supply, power, and irrigation. His account was very interesting and contained many humorous anecdotes.

His talk closed with a discussion that engineers just out of school were liable to think wholly in terms of design and very little of probable costs. He also added that personal profit should be taken when rightfully due. One should not glory so much in personal achievement that he forgets his personal needs.

A. I. Ch. E.

The members of the A. I. Ch. E. were privileged to hear Bruce K. Barton, a patent attorney for the Standard Oil Company of Indiana, discuss the complexities of patent law at a meeting held Friday, January 15, in Science Hall. The growth of the government patent law department, the intricacies of modern law, and the method of patent application were all outlined.

At a meeting held on February 19, the annual award of the professional chapter of the Institute, a gold scholarship pin, was awarded to Harold Goldman for having attained the highest average in the chemical engineering department among the freshmen.

Friday morning, February 26, saw a Joint meeting conducted with the local chapter of the A. S. M. E. The speaker was Mr. Dedo of the Ethyl Gasoline Corporation. His topic was, Anti-Knock Gasoline. The effect of tetra-ethyl lead upon the knocking properties was conclusively shown with the aid of an internal combustion engine. The meeting was of such interest, that more lectures of this type will be given in the near future.

A. C. S.

At a joint meeting of the Chicago Section of the American Chemical Society and its Petroleum Division held Friday night, January 22, Mr. T. A. Boyd, of the research laboratories of General Motors Corporation, spoke on "Chemical Researches in Engine Combustion." The relationship between chemical constitution and the "knock" properties of the various hydrocarbons was pointed out.

On Friday, February 10, another meeting was held at the Midland Club. The speaker was Dr. S. P. Kock.

OUR VARSITY CAPTAINS

Swimming

Andrew H. Weston

"Andy" Weston, a senior in the department in the electrical engineering, is pilot of the Armour Tech swimming squad. During the short time he has been here, Andy has proved thoroughly capable of maneuvering a competent array of swimmers through a very successful season.

Andy is a product of Stockholm Sweden. After graduating from Tilden Tech, he attended Crane Junior College and competed in several meets

Andrew H. Weston

under Crane's colors. After two years of training there, he enrolled at Armour and quickly displayed his prowess as a tankman. His earnest hard work was soon rewarded with a well deserving promotion—a captaincy.

A great deal of his spare time was spent in the water. This, combined with his natural ability, carried away many laurels in strong competiton. His list of conquests in this field is quite long. Any long distance swimming contest seems to appeal to Andy only too greatly. This is evidenced by the number of marathon swims in which he has participated. Some races have exceeded twenty miles.

A second place gold medal and cup was awarded our captain for winning the 20 mile swim at Quincy, Illinois. Other trophies may be counted in his vast collection. For two consecutive years, Weston has won the Chicago-Rogers Park Lake Swim. As a reward, two silver merman statues have been presented to him. As a means of keeping in condition, Andy acts as life guard during the summer months.

A. I. E. E.

The Armour branch of the A. I. E. E. held its first meeting of the year on January 8 in Science Hall. Four reels of motion pictures, donated by the General Electric Company, were shown. They covered the following subjects:

1. Conquest of the Cascades.
2–3. Induction Voltage Regulators.
4. Vitreous Enameling Process.

The pictures illustrated the remarkable accomplishments of the modern electrical engineer.

A talk on mercury arc rectifiers was given on January 22. The speaker was Mr. Cassidy of the General Electric Company. The principles of rectification, the modern use of rectifiers and their future use was explained.

E. E. Chilberg, another member of the General Electric Company, was the speaker at a meeting held on Friday, February 19. His topic, Building Network, considered the care and protection required to insure constant electrical service in large buildings where the continuity of service is absolutely essential.

A. S. M. E.

Mr. R. E. Turner, managing editor of "Power Plant Engineering," spoke on January 15 to the members of the Armour branch of the A. S. M. E. on the subject of "Advancement in Generation of Power." The many improvements and developments in this field were pointed out.

On Friday, February 26, a joint meeting was held with the local branch of the A. I. Ch. E. The speaker was Mr. Dedo of the Ethyl Gasoline Corporation. The lecture was exceedingly interesting and it is hoped that more lectures of this type will be held in the future.

F. P. E. S.

The Fire Protection Engineering Society held its first meeting of 1932 on January 22. The chief instructor of the Fire Department, "Smoky" Rogers, was the speaker for the occasion. The gathering was novel in that it was conducted on a classroom basis, passing out a sheet containing a true-false quiz on fire protection principles. After the "exam" an informal discussion was held.

Plans are now under way for a smoker to be held sometime in April or May.

Weston's work on the squad has continued to be excellent. His fine work throughout his career has earned him a membership to the Honor "A" Society. Due to his musical ability Weston has also been claimed by Pi Nu Epsilon, the honorary musical fraternity.

Basketball Squad Brings Season to a Close

Armour Tech's squad of basketeers has turned in a very commendable list of victories. Considering the season's schedule, which was one of the hardest ever arranged for Armour, the team has shown itself to be superior to many of the various strong college aggregations. Teams such as Michigan State Normal, De Kalb Normal, and Detroit City College either headed their respective divisions or were very close to the top.

The competition offered by Armour against the strong Ypsilanti squad, at Michigan, is to be commented upon. The Tech aggregation has won exactly seven of its games and has only six defeats chalked up against it. The scores of a number of the losses were decidedly close. On the other hand, quite a number of victories have been by large margins. The team defeated Wheaton, Crane, Augustana, and "Y" College.

Against the strong "Y" College squad, Armour opened a series of surprise attacks which resulted in their ultimate victory. At the end of the contest the score stood 25 to 22. Then followed a close game with Crane College at Crane. The opponents came out on top by a score of 27 to 24. In the following game, the cagers avenged themselves on Augustana to the tune of 22 to 16, having lost the first game with that team. Developing a much stronger attack and defense, the Tech players came to their season's close with a rush, and finished with a victory over Michigan State Normal in their last appearance of this season.

Baseball Season Soon to Be Under Way

With the early spring weather already crowding out the winter, baseball again is beginning to make its appearance on the campus. Coach Kraft recently made a call for pitchers and catchers. An unusually good turnout of sixteen men resulted.

The schedule for the 1932 baseball season has been arranged as found below. This schedule, however, is not definite at this writing, there being the possibility that some open dates may result. However, negotiations are under way for the filling of such open dates if it becomes necessary. The schedule is as follows:

April 12—Morton at Armour.
April 16—Armour at North Central.
April 19—Armour at Elmhurst.
April 22—Wheaton at Armour.
April 29—North Central at Armour.
April 30—Armour at Michigan Normal.
May 4—Armour at Mt. Morris.
May 7—Armour at Lake oFrest.
May 11—Lake Forest at Armour.
May 12—Michigan Normal at Armour.
May 17—Mt. Morris at Armour.
May 20—Elmhurst at Armour.
May 21—Armour at Wheaton.

Swimming Team Tackles Strong Opponents

Represented by one of the strongest squads produced in several seasons, Armour Tech's swimming team has turned in three victories while only two defeats have been chalked up against them. One of these contests was a hard fought battle with Crane College. Crane came out on top with a lead of only one point. With three other meets scheduled, the mermen are confident that they will raise their winning percentage considerably.

The victory over Chicago Normal disclosed the caliber of quite a number of new men. Among these, Cassil and Robson proved that they would become divers of repute. All men were compelled to do four specific dives and three of their own choice. After some neat work, the Armour divers succeeded in capturing first and second places. From the initial event on, Armour men showed form far superior to the Normal swimmers. Coach McGillivary is mighty pleased with the work of his boys.

Swimming Team 1931-32

Reading left to right; back row: Bernstein, LaForce, Carlstrom, Davison, Ahern, Weston, Dirkers, Mgr., McGillivary, Coach. Bottom row: Kolve, Cavanagh, Jung, Giovan, Krueger, Byanskas.

Weston, Kolve, Carlstrom, Cavanaugh, Giovan, La Force, Ahern, Bernstein, and Byanskas have kept up their excellent work in all meets to keep Armour in the lead. With such an array of veterans and oncoming material, the tankmen are not likely to succumb to a defeat without a hard struggle.

De Pauw University, new to the Tech schedule, succeeded in sinking our squad in a meet at the U. of Chicago pool, Friday, February 19. The Armour swimmers are confident, however, of avenging themselves in a return meet to be held at Greencastle, Indiana, later in the season.

Our swimmers again took on the Illinois Wesleyan squad, at Bloomington, on February 26.

Track Teams Show Unusual Strength in Early Meets

Led by Captain "Chuck" Jens, and greatly aided by George Nelson, Sademan, Lind and Hirsch, the Armour squad of runners have turned in many a victory to date. With their combined efforts, the trackmen have been able to enter strong competition and give a promising account of their ability as a team. In the first contest, a triangular meet including Armour, La Grange, and the Chicago "B" team, Armour showed its superiority in garnering 57½ points to thoroughly cinch the meet. Under the ideal conditions presented to them by the University of Chicago fieldhouse, the Armour tracksters displayed their fine ability by winning nine first places. Individual high point honors went to Nelson who scored 19 points by winning the low and high hurdles, broad jump, and tied for first in the high jump. He also ran on the winning relay team as anchor man. Sademan and Lind ran fast races in the mile and the 880 yd. run respectively, showing rare form.

Judging by past performances, the track team will continue its drive for points for the honor of Armour Tech. With the arrival of spring and the outdoor season, an incentive is offered for participation in all track events.

Rifle Team Again Wins State Championship

The Armour Rifle Team, for the second consecutive year, distinguished itself by winning the Illinois State Rifle Association 1932 Championship in the fifty foot division. Such a championship assumes even more distinction in view of the stiff competition encountered in the meet. The teams who participated in the match and the order in which they placed is as follows: Armour Tech with 5589 points, Slifer Post of the American Legion with 5441, Des Plaines Post of the American Legion with 5296, and the 132nd Infantry of the Illinois National Guard with 5172 points. The match was carried on for a period of six weeks, being concluded on February 19.

Among other achievements of the rifle club this year we find a victory over the Westric Rifle Club, an organization of Western Electric Company employees. Here, over a seventy-five foot range, the Tech team won by a score of 1059 to 1043, giving the Westric group its first home defeat since 1919.

Matches have also been won from the Appleton Club of Appleton, Wisconsin, and the Stuyvesant Club of Stuyvesant, N. Y. During the mid-year examination period practice was greatly curtailed and two defeats were received at the hands of Ohio State and the University of Iowa.

The club, as a group, has an increasing membership and hopes to gain some new and promising team material soon. A fair number of rifles are already owned, but a constant effort is being put forth to gain increased facilities for practice.

The rifle team this year is distinctly an asset to the school and the student body as a whole can well be proud of the Armour rifle team. In the past year, harder competition than usual has been sought after and in the face of such competition, the team has shown up remarkably well.

Plans for Armour Relays Progress Rapidly

Armour's fourth annual Indoor International Track Meet will be held on Saturday, April 2, at the new University of Chicago fieldhouse.

The Invitational this year has been enlarged to become a Relay Carnival, and will be supervised by Armour men and coaches. Invitations have been sent to all Big Ten universities as well as about thirty smaller colleges. The following events are scheduled: College Relay—half mile, one mile, and two miles; University relay—one mile, two miles, and distance medley; Special Events—75 yds. low and high hurdles, 440 yd. dash, 880 yard run, one mile run high jump, broad jump, pole vault, and shot put. The Armour Tech Athletic Association is financing the meet, and the program is to be arranged by John J. Schommer, athletic Director.

George Nelson and Capt. C. Jens are among the many Tech men to be in the competition. The former, high point man of last year's team, and holder of four Armour indoor school records, is expected to win several points for Armour in one or more of the following events: high jump, low or high hurdles, broad jump, and the 880 yard run.

Capt. C. Jens, shot putter and dash man, will have an opportunity to gain some points for Armour. K. S. Hirsch, quarter miler, and Elmer Sademan, distance man, are the other major letter men who will compete for the honor of Armour.

The Relay Carnival will be held under ideal conditions. A "seven laps to the mile" track, and a 75 yard straightaway provide the competitor's every opportunity for fast time. No doubt, under such conditions, and with the expected competition many records are apt to fall.

Pi Tau Sigma

Pi Tau Sigma, honorary mechanical engineering fraternity, held a business meeting in the Tau Beta Pi rooms, Thursday, March 3rd. Officers for the spring semester were elected as follows: Pres., R. F. Waindle; Vice-Pres., J. S. McCall; Rec. Sec'y, W. G. Buehne; Corr. Sec'y, A. Bogot; Treas., A. J. Jungels; Cataloguer, E. H. Chun. As has been the custom in the past, a Kent's Handbook will be presented to the highest ranking sophomore in the M. E. department; the presentation to help foster higher scholarship in the department, will be made at the opening of the next semester.

To further foster interest in the field of mechanical engineering, Pi Tau Sigma wishes to announce that awards will hereafter be made for the two best papers pertaining to mechanical engineering subject matter which are presented by members of the freshman and sophomore classes in that department. These papers, 4000 words or over, must be presented to Prof. Gebhardt by May 13, 1932. They are to be judged by the department faculty, and by members of the fraternity. Judgment will be based upon subject, originality, presentation, and English. The winning papers will be considered seriously by the editors of the Armour Engineer, with a view to possible publication.

Eta Kappa Nu

Eta Kappa Nu, honorary electrical engineering fraternity, has announced its annual essay contest. This competition, open to sophomore electricals, is held each year with the purpose of stimulating extra-curricular investigation in some engineering subject. The papers are to be 3,000 words in length, annotated in complete fashion, and submitted to the judges by May 15. The winning contestant will be awarded a copy of the Standard Handbook for Electrical Engineers, suitably engraved with the recipient's name.

On March 8, Delta chapter held a joint meeting with the Chicago Alumni chapter at the Adler Planetarium.

Cover Design

Staff artist's drawing of the Travel and Transport building of A Century of Progress, Chicago's 1933 World's Fair. This building, architecturally unique, is nearly 1,000 feet long. The cable suspended dome is 125 feet high and 200 feet across and encloses the largest unobstructed area ever enclosed by man beneath a roof. It represents the first application to architecture of the suspension bridge principle. In this dome the story of transportation's progress during the last century will be dramatized.

Truss Club

The Truss Club is having a highly successful year, and boasts a present active membership of 13. The officers in control at present are:

President—C. F. Lane.
Vice-President—W. L. Jost.
Treasurer—T. Ladzinski.
Secretary—W. C. Hoffman.

A number of social events have been held during the school year, among the most recent of which was a very well attended alumni smoker held at the club-rooms in January.

A dance for both active and alumni members was presented on February 13, 1932.

Alpha Chi Sigma

The student chapter of the professional chemical fraternity will have a number of activities in the spring semester. Officers elected to serve for this period are: Pres., A. M. Ream; Vice-Pres., P. Bestler; Rec. Sec'y, S. E. Winegar; Cor. Sec'y, A. H. Helmick; Treas., S. Johannisson; Alumni Sec'y, J. J. Dohney, Jr.

The chapter wishes to announce the following newly initiated members: R. H. Schorling, '34; K. Eberly, '34; R. W. Marty, '34; D. J. Mullane, '34.

A dinner and theater party was held to honor the new initiates on March 4. "As Husbands Go" was seen and enjoyed by both the students and the two faculty members present, Profs. Tibbals and Carpenter.

The fraternity planned a smoker for March 10, at the Beta Psi house, in order to make the acquaintance of prospective members in the sophomore and junior classes. Plans are in the offing for either an elaborate theater party or dance to be presented early in the next month.

Tech Boxers Near End of Tough Schedule

The opposition encountered by the Armour pugilists has been turned aside after a very hard struggle. The Tech boxers seem to give an unexpected spurt at the last moment to come out on top. Led by Captain Sandstrom, the team has shown great form in winning their matches. Heckmiller, Campione, Marcus, and Bacci have shown that they are good timber for fast company.

A tie with the well known South Chicago "Y" team proved that Armour has a fighting outfit. With only six bouts on the program Armour boxers won three to tie with the former. Joe Campione produced the tieing win by knocking out his opponent in the last bout of the evening. Behmer scored the first victory for Armour, and Sandstrom also defeated his opponent. Marcus, Schmidt,, and Core lost very close decisions to their opponents. A return match was held with the South Chicago "Y", February 5, which was dropped by a match score of 3 to 2. On February 18 the strong Valporasio team was pitted against the Tech team. This meet also was lost after a real struggle by a count of 3 to 2. In connection with this meet four wrestling bouts were also staged, one of which was won by Armour, Talaber being the only successful Armour wrestler.

On February 26, Armour met and defeated the St. Viator team by a match count of 4 to 1. These bouts were held in the Armour gym and were well attended. Spectators were well paid for their attention as the five bouts were well contested, three being settled by decision and two by technical knockouts.

It is indeed gratifying to see that a much greater interest has been taken in the activities of the boxing team this year than ever before. Armour is represented this year by a team of unusually talented men and a most sincere group of hard workers who deserve every bit of the support that the student body can give them.

Sphinx

The honorary literary fraternity has entered into a period of regular and organized activity in order to advance the Tech publications in all journalistic phases. Discussions will be held and each editor will be able to gain friendly aid to his troubles.

Sphinx has decided to sponsor an informal smoker to replace the annual Press Club affair, now dropped from Armour's social calendar. The officers will obtain as the evening's guest and speaker, some outstanding journalist of the Chicago area. The smoker is planned for the middle of March, and all staff members of the Armour Engineer, the Cycle, and the Armour Tech News will be cordially invited.

The various school publications have a number of outstanding journalists employed, many of which are juniors. Sphinx is following their development closely, and will pledge those worthy of the honor at a later date.

The Armour Alumnus

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Alumni Club Organized in Kansas City

The strong bond of common friendship and regard between the graduates of Armour is once more brought to light. This time the feeling is not a result of the proximity of the alma mater, but springs up in Kansas City, Mo. A few weeks ago a letter was received by Dr. Raymond telling of the organization of the A. I. T. Luncheon Club of Kansas City. The first meeting of the club was held at the City Club. The plans of the club, it was stated, are to meet each Friday in order to renew old and make new friendships among all Armour men in Kansas City. A cordial invitation was extended to all Armour men to attend any of their luncheons at any time they are in or near Kansas City.

A list of the charter members and their present occupation was also forwarded to Dr. Raymond. The list included twenty-eight Armour men who are at present working in Kansas City. A complete list of Armour gradautes living in Kansas City was forwarded by Dr. Raymond's office in order that there might be no oversight in attempt to locate all those in the city.

Dean Penn commenting on the formation of this club, said, "I was surely agreeably surprised to learn that Kansas City holds so many of our Alumni. Although I do not recall each individually, I recognize the names of all. I even find a classmate of mine on the list."

"Doctor Raymond sends his best regards to all and requests me to say that he wishes you all good luck and the best of health, and that the Armour Institute of Technology is proud to have such a fine group of Armour boys in Kansas City."

Below will be found a list of the charter members of the A. I. T. Luncheon Club of Kansas City.

Atherton, Henry B.
Beck, Charles E.
Bradbury, Gilbert V.
Cohen, Morris
Cook, Ellis C.
Edstrand, John P., Jr.
Graham, Frank A.
Green, Louis S.
Hillyard, R. T.
Jackson, Carl G.
Jones, Lee B.
Joslyn, Raymond O.
Katz, Isadore G.
Keeth, Jacob A.
Larson, David E.
Macy, Kent L.
McDonald, Edward L.
Natkin, Benjamin
Parker, John H.
Peters, William H.
Pines, Sidney
Reinhardt, Julius V.
Scanlon, Emmett A.
Schreiber, Herbert F.
Smith, Robert A., Jr.
Shepard, Harry R.
Waterman, Arthur T.
Webster, Sheldon H.

Schommer Assumes Added Duties at Institute

John Schommer, president of the Alumni Association has again stepped to the front, this time as a newly appointed member of the Armour Institute Development Committee. Professor Schommer has held the presidency of the Alumni Association for the past few years as well as being a member of the Board of Trustees of the Institute. John, as he is more commonly known, has since his first connections with the Institute, continualy worked

John J. Schommer

for and cooperated in every way for a steady advance and buiding up of the school. In his latest appointment we see a recognition of his ability and willingness to work and sincerely wish him continued success in all of his duties or undertakings.

The members of the Development Committee are as follows: James D. Cunningham, chairman, Philip D. Armour, chairman of the Board of Trustees, Alfred S. Alschuler, Lester Armour, John J. Mitchell, and John J. Schommer.

Armour Architects Win New Laurels

The capabilities of Armour architects was once more evidenced in a contest between Cook County Architects in the "Masonite House" competition held recently.

Mr. Raftery, a former professor at Armour, and Mr. Frazer, both of 644 North Michigan, won the first award of $600.

The second award went to two of Armour's graduates, Conners and O'Connor, of 540 North Michigan Ave.

Honorable mentions were given to E. Fuhrer, '23, A. H. Bacci, '26, I. Lobel, '21, H. E. Turk, '29, and N. J. Schlossman, '21, all graduates of Armour. Those chosen were from a group of sixty-nine. The selections were made by a board appointed by the president of the Chicago Chapter of the American Institute of Architects.

Alumni Association Increases Student Loan Fund

An earnest endeavor is being made by the Alumni Association to provide funds so that worthy students who are lacking the necessary money, might continue their education. Although there exists a Student Loan Fund to be used in such a case, during the last few months there arose such a need for help that the fund provided was inadequate. It was here that the Alumni Association helped. A letter was sent by Mr. Louis Hirsh to various alumni, informing them of the situation. The following is this letter in part:

Dear Fellow Alumnus:

The demand this year, due to the unemployment and bank failure situation, for student loans was more than the loan fund could handle. A situation arose where some excellent Seniors could not graduate due to the fact that their parents were either unemployed or had lost their savings in recent bank failures.

Mr. Byrne, our worthy Chairman of the Student Loan Fund, President Schommer and Dean Penn called me to see whether something could not be done to help the situation. I suggested that as we had accumulated a balance of $1,000, it would be only right for us to loan about $500 to the Student Loan Fund. I personally interviewed every one of the students recommended by the Dean's office for a loan, and found that they were all fine boys with high ideals, and really deserved assistance. The handshake and gratitude I received from these students will remain with me for a long, long time.

It is for this reason I am sending this letter to the Alumni, since they are a part of the Association. We want every one of them to rejoice with us in this opportunity. We want every one to take an active part. You can best do it by paying your dues, and as many of you as can afford it, by becoming life members. The dues are $3.00 and the Life Membership is $40.00. The dues are kept by the association to defray expenses, but the Life Membership goes direct to the Student Loan Fund.

The demand, indeed, was so great we were compelled to increase the loan limit from $500 to $750 and I felt very badly indeed that I could not make it any larger, since the balance in the bank was so depleted.

The officers are your servants, and want to be as useful as they possibly can be. I would, therefore, appreciate it if you will take this letter as a personal appeal, and either pay your dues, if you have not done so, or try to become a Life Member if at all possible.

Louis Hirsh.

News has reached the Dean's office of the death of Walter Leo Juttemeyer, M. E., '15. Mr. Juttemeyer passed away last summer.

Personals

Among the communications received by the Alumni Association one has arrived from Figueras, Spain. Upon being translated, it was found that it came from the brother of Jose A. Bech, '28, and stated that the sender and his mother have lost trace of senor Bech and desire assistance in locating him. It was hoped that some person knowing the whereabouts of senor Bech might inform the Institute or the Alumni Association in an effort to help his family locate him.

Karl E. W. Hellsen, C. E., '31, paid the Institute a short visit recently. He was, at the time, on his way to Boston to take up graduate work at M. I. T.

Charles A. Link, M. E., '31, is now employed at the General Electric Company.

Vito J. Abazoris, M. E., '31, has been employed since graduation last June with the Buda Motor Company, manufacturers of automobile motors.

Mitchell J. Lamka, M. E., '31, is doing engineering work with the Bendix Automotive Corporation.

Elihu O. Pierce, F. P. E., '24, is now local agent for a number of insurance companies in Toledo, Ohio.

Don G. Skaer, F. P. E., '28, who is an employee of the Colorado Inspection Bureau and located in Denver, recently surprised his many friends by returning from his vacation trip to California, with a life partner.

Arthur T. Waterman, F. P. E., '24, is under the guidance of the Missouri Inspection Bureau located in Kansas City, Mo.

Marshall G. Whitfield, Ch. E., '30, recently completed his graduate work at Columbia University. He was awarded the degree of chemical engineer, completing the regular three year course in one year.

Walter H. Hallstein, C. E., '14, who until a few months ago held the position of purchasing agent for the Ilg Electric Ventilating Company, is now president of the company.

Manuel Yzaguirre, Ch. E., '31, is under the guidance of Armour and Company at the present doing chemical research work.

A. J. Lenke, F. P. E., '31, who until a few months ago was working for the Wisconsin Inspection Bureau, in Milwaukee, is now located in Chicago under the employ of the Chicago Board of Underwriters.

E. A. Johnson, C. E., '31, is busily engaged advising the War Dept. on th' rights and wrongs of dam construction as is attested by his work on the Dresden Island lock and dam which is being constructed near Joliet, Ill. as a part of the Lakes to Gulf waterway project.

Alumni Receive Letter From Mrs. L. C. Monin

The following letter was received by Mr. Louis Hirsh, Secretary-Treasurer of the Armour Alumni Association:

Zurick, December 27, 1931.

Armour Alumni,
Gentlemen:

I deeply appreciate and gratefully acknowledge your kind expression of sympathy.

Very sincerely,
Mrs. L. C. Monin

How Schommer Joined A Famous Club

The following story is dedicated to Professor John Joseph Schommer, Assistant Professor in Industrial Chemistry, Armour Institute of Technology, and President of the Alumni Association of that college. The story is a quotation from one by Arch Ward in the Chicago Tribune, so this writer accepts no blame as to its origin. But let us qoute Arch Ward:

"Judge Walter P. Steffen, one of the greatest players Stagg ever developed, tells an interesting story illustrating how the Maroon leader emphasized his wrath when plays went wrong.

'Whenever he became disgusted with one of his players,' said the judge, 'he would call him a jackass. After a few years the boys on the squad organized what is known as the "Jackass Club." Whenever a man was called jackass by Stagg he would be elected to life membership.

'There were two outstanding incidents with reference to the Jackass Club which come to my mind. One evening John Schommer, who was a famous all around athlete, was playing in a scrimmage. He had not had much previous football experience. He received a forward pass over the goal line, touched the ball down for a touchdown, and immediately threw the ball into the field of play, thus depriving his team of opportunity to kick goal. It was a rule at that time that the ball, after it had been downed for a touchdown, could not again be touched to the ground until the kicker in trying for a goal after touchdown, kicked the ball. If the ball was accidentally or inadvertently touched to the ground, the side which had scored the touchdown would be deprived of the chance to kick the goal.

'Mr. Stagg immediately shouted, "You jackass!"

'Schommer was automatically elected to life membership in this organization. Many times he has told me how infuriated it made him and that he could barely resist doing violence to Mr. Stagg'."

Among the replies to the appeal for the addresses of "lost" alumni, two have arrived concerning the whereabouts of Mr. J. R. Lossman. One comes from Mr. N. C. Narten, '30, who writes from Eau Claire, Wis., and the other from Mr. Claude M. Westerman, '31, who is now in Wheeling, W. Va. They both state that Mr. Lossman, '30, is at present situated in Lakewood, Ohio, where he is working for the Ohio Inspection Bureau.

Personals

Walter White Drew, E. E., '11, has been appointed division traffic superintendent for the Western Union, it was announced recently. He succeeds the late Charles R. Fisher. Mr. Drew was formerly the division traffic engineer of the Western Union for the lakes division.

While at Armour Mr. Drew belonged to Tau Beta Pi, Omega Lambda, Eta Kappa Nu, and A. I. E. E., as well as being Treasurer of his class.

George Jennings, '31, holder of more titles than we care to enumerate, has again been ranked as Chicago's leading tennis player, according to rankings issued by the Chicago Tennis Ass'n. Previously George Lott, Davis Cup Star, held this rank, with Jennings second.

John Even, F. P. E., '28, was married to Miss Lucille Whinney of Peoria in January.

Fred C. Dierking, C. E., '12, is now employed as sales manager of the Buresch Motor Co.

Eugene Voita, Arch., '25, and Carl A. Gustafson, E. E., '28, recently visited the Institute and were very much surprised at the improvements in the various buildings.

Mr. Leslie C. Meyer, '14, stopped at the school on Monday, January 18, for a brief visit.

C. M. Nelson, '26, is now the editor of a magazine, "Better Roads," which has just put out its second issue.

S. L. Ray, Arch., '19, is employed as a life insurance agent for the New York Life Insurance Company.

T. R. Schueler, F. P. E., '31, is located in Omaha, Nebraska, with the Nebraska Inspection Bureau.

L. O. Castle, F. P. E., '27, is still with the James S. Kemper Company of Milwaukee, Wisconsin.

Leo A. Ohlinger, C. E., '27, is now connected with a large concern of consulting engineers.

S. T. Leavitt, formerly of the Armour Tech News, is at present on the staff of the M. I. T. newspaper.

Carl Stockholm, '24, is one of the foremost six-day bike racers. He is also the proprietor of a thriving cleaning business in Chicago.

E. F. Rutkowski, '29, and C. H. Johnson, 29, are working in Dresden, Iowa.

Henry B. Weis, '31, is studying at St. Louis University.

F. B. Atwood, Ch. E., '31, is now selling filtration equipment and a solution for locker room floors to prevent "Athlete's Foot."

Death of Shimizu a Surprise to His Many Friends

It is with regret that Armour announces the passing of one its alumni, H. Sanjiro Shimizu. He died at his home in Chicago on October 15th, at the age of 55. Mr. Shimizu was born in Oita, Japan, January 9, 1876, and received his early education in Japan, before coming to America for his engineering training. He then chose Armour Institute of Technology and graduated in 1903, receiving his B. S. in the Department of Mechanical Engineering. He was given his professional degree, mechanical engineer, here in 1907. From January, 1904, to July, 1910, he was associated with the John S. Metcalf Company, Chicago, on the design of some of the larger grain elevators built in this country. When that company moved its offices to Montreal, he decided to remain in Chicago and took a position with Roberts & Schaefer Company as an estimator and designer and remained in that capacity until a few years ago when he went into business for himself as an exporter of machinery and engineering supplies to Japan.

Isadore Drell, Ch. E., '31, is now employed by the Chicago Sanitary District.

Willar S. Denning, M. E., '31, is a perfect example of the well known fact that a graduate engineer does not always stay in the profession he is schooled in, since he has recently entered the insurance field in New York City.

Any complaints (or compliments even) on the Illinois Highways which might be tendered may now be referred to Roscoe H. Windbigler, C. E., '31, who is now employed by the Illinois State Highway Dep't, at Streator, Illinois.

Among the new men acquired by the United States department of Engineering we find; Leonard H. Dicke, C. E., Charles W. Wyant, C. E., and Bert S. Lindquist, C. E., all from the class of '31.

Don M. Fetterman, E. E., '31, is assisting in the completion of an electrical book for the American School of Correspondence.

Alvin B. Auerbach, C. E., '31 is at the present time working overtime in preparation for his masters degree at the University of Illinois.

Oliver A. De Celle, Ch. E., '14 has recently become vice-president of the International Filter Company located in Chicago.

Frank E. Rutkowski, C. E., '31 has changed his base of operation from the U. S. Geological Survey to the Division of Highways of the State of Illinois at Paris, Ill.

Rudolph Patzelt, E. E., '31, is at the present time attending the school given by the Commonwealth Edison Company.

Alumni Visitors Note Many Institute Improvements

A number of changes in the chemical engineering laboratories together with considerable rearrangement of the chemical engineering laboratory equipment, was made possible by the construction of a concrete balcony in the room formerly used as a combination laboratory for metallurgy and chemical engineering. The construction of this balcony almost doubled the floor space in this laboratory and at the same time, left ample head room in both stories.

Considerable of the equipment previously housed in the chemical engineering laboratory on the fourth floor of the main building was transferred to the new laboratory. This equipment included all of the equipment for heat transfer and evaporation, except the open steam jacketed kettles which were left in their previous location. The equipment for chemical engineering experiments in filtration was also transferred to the new laboratory. The gas fired furnaces formerly located on the first floor of this laboratory were moved to the second floor and arranged under a hood so as to provide ample ventilation for any fumes arising from the furnaces.

The removal of the equipment, previously mentioned, from the fourth floor laboratories in the main building made it possible to rearrange the equipment which had been left in this laboratory. With the arrangement of this equipment, all of the plumbing, such as steam lines, water lines and waste lines, were renewed. This was done as a precautionary measure, as the old plumbing had been in about twenty years.

The moves previously mentioned also made it possible to devote one of the small rooms on the fourth floor of the main building to the specific use of the laboratory class in metallurgy. The equipment in this room was all rearranged. A dark room was built for the convenience of students making photographs of the micro structure of the ferrous and non-ferrous alloys.

The camera for this work and the fine polishing machines were also installed in this laboratory.

It is the intention, also, to place in this laboratory, permanent set-ups of such apparatus as will be required for the specific analyses of ferrous and non-ferrous alloys.

The space used by the laboratory classes in physical and electro chemistry was increased last year. The working conditions in this laboratory, however, were much improved by adding increased locker and work table space during the past summer. Further improvements in this laboratory are contemplated, such as permanent installations of galvanometers, equipment for potentiometric titrations, constant temperature baths and certain calibrating instruments required in this laboratory work.

The physical appearance of most of the laboratories has been much improved by cleaning and painting the walls and ceilings.

There has been used in all of the laboratories, a special paint containing no lead or iron pigments so that the tints in the paint will not be injured by the laboratory fumes.

These increased facilities have been made necessary by the increase in the number of students in the advanced classes in engineering and by the expansion of the requirements in the laboratory work at the Institute.

F. P. E. Alumni Resent Being Ignored

In the December issue of the magazine "Chemical and Metallurgical Engineering," there appeared an editorial on the subject, "Needed—Training for the Fire-Prevention Engineer."

The appearance of this article was indeed a surprise to many alumni of the Fire Protection Engineering course as well as the administrative officers of that department. In the main the article expressed a sincere regret that the public had never been awakened to the necessity of trained engineers in the field of fire protection and prevention.

It was indeed gratifying to learn that a number of alumni wrote immediately to the editor, questioning his authenecy for writing such an article. In addition to the letters written by the Alumni, Professor Finnegan, head of the Department of Fire Protection Engineering, wrote a letter to the editor informing him of the presence of the course in question, outlining its 29 years of history, and the salient features of the curriculum and subject matter touched upon. As a consequence, we find in the February issue of the same magazine a correction article which contains the letter written by Prof. Finnegan.

It is indeed regretable that such a course should be entirely overlooked but when it does happen, the quick and sure-fire response of the alumni serves as a check and if in no other way, people will generally come to know and hear of the course in Fire Protection Engineering at Armour, through the alumni who are the ultimate products of the course.

Doctor Raymond Ill

Sickness has unfortunately confined president Raymond to his bed for several weeks. He was taken ill Wednesday, February 3 and has not been able to return to the Institute as yet. However, he is reported to be making progress and it is hoped will be able to return in the near future.

George Rezac, C. E., '29, visited the school Tuesday, January 19, and conducted the orchestra practice.

Samuel F. Henderson, E. E., '26, is now connected with the Westinghouse Electric Company in Pittsburg, Pennsylvania.

R. F. Steward, Ch. E., '07, has moved his office as patent attorney from Washington, D. C. to New York City.

Andrew S. Hartanov, M. E., '31, is now employed in the methods department of the Walter and Beck Co., Inc. Both Walter and Beck are graduates of the mechanical engineering department of Armour.

The Advance of Bacteriological Engineering

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molecule of carbon dioxide. On the other hand, if calcium carbonate is added to the cultures large yields of the calcium salts of acetic and butyric acid are produced with corresponding diminution in the formation of acetone and butyl alcohol.

At the present time, however, the acetone—butyl alcohol process can only be worked with profit in such regions as the maize belt of the United States, where freightage is avoided owing to proximity to the source of the raw material. The magnitude of the production in this corn belt can be judged from the fact that in 1930 there were approximately 150 fermenters, each of 50,000 gallons capacity, necessary to keep up the required rate of production. Although the above process is local in its industrial character, the principles involved are typical of the field, and hence, a description of the specific process will be enlightening. The particular name for this fermentation reaction is the "Weizmann Process."

Corn is the basic raw material used in the process. It is screened to remove fine matter, passed over a magnetic separator to remove iron fragments, and finally passed through a dry degerminating process. The bran and germ cake thus obtained are sold for feed, and the fine meal is conveyed to bins from which it is weighed into conveyors which carry it directly to the cookers. These cookers are essentially closed autoclaves provided with agitators. Sufficient meal and water are mixed in the cookers to give a mash of approximately 8 per cent concentration by weight, and the resulting mixture is cooked with live steam under pressure, this operation serving the double purpose of sterilization and conversion of the starch into a more soluble form. At the conclusion of the cooking the charge of mash is blown into the fermenters, passing, as it moves, thru heat exchangers where it is cooled to a temperature of approximately 37 degrees Centigrade. The "Bacillus clostridium aceto-butylicum" which accomplishes the fermentation of starch solution to butyl alcohol and acetone is found in soil, cereals, fruits, ect. When a pure culture of the organism is isolated it is used to inoculate a sterile starch solution in a test tube. The bacterial spore is then activated by heating and fermentation allowed to take place at 37 degrees Centigrade. At the end of 24 hours, this culture is transferred to 500 cc. of sterile medium and again allowed to "incubate." This process is continued for increasingly larger proportions until a mash of about 50,000 gallons has been treated. After the fermentation the solvents are removed and separated by fractional distillation.

As has been mentioned before, the above process yields profit only in certain desirable districts but, apart from such a present day economic consideration, the value of this and other similar processes lies largely in the fact that it may be regarded as a reserve method of manufacture which could be brought into operation in the event of any urgent demand arising for increased supplies of the solvents which it yields. These remarks are applicable to another interesting biochemical transformation which has been investigated in England and in America during recent years, namely, that of the bacterial production of ethyl alcohol and acetone from pentoses. Laboratory investigations were carried out in a small technical plant and an ingenious method was devised for the hydrolysis of the pentosans of waste vegetable matter which with subsequent treatment with the organism "Bacillus acetoethylicus" suffered complete conversion to acetone—alcohol mixtures.

While we are on the subject of waste material it is to be noted that in both England and Germany there has been a successful utiliaztion of waste material as a source of power in the processes for the production of power gas by the fermentation of sewage sludge. At Essen, gas is being produced having a calorific value ranging from 780 to 1000 B.T.U. and the cost being estimated at the low figure of about ¾ to 1 cent per cubic meter. At Birmingham, England, there is an installation with 144 gas collectors which, launched on the sludge tanks, give a yield of 16 million cubic feet of gas per annum. It has been estimated that total utilization of the waste sewage in the concentrated urban districts of England would yield about 5000 million cubic feet per year, which figure, obviously, represents a great economic factor.

The recent introduction into chemical industry of numerous new solvents, many of which are the esters of well known and simple organic acids, lends additional interest to experiments which have been carried out on the production of propionic acid from certain sugars through the agency of bacteria which occur in Emmenthaler cheese. In addition to the lactose, maltose and glucose which these bacteria can attack in the cheese, are other substances which they can utilize for their nutritional requirements, notably glycerol and calcium lactate. From the latter, propionic and acetic acids are formed in the ratio of 18 parts to 10 parts respectively. The propionic fermentations suffer, however, from the serious drawback that they proceed at a slow rate. To counteract this, experiments have been made to show that the reaction can be speeded up, and the process appears likely to come into industrial use as soon as is warranted by the growing demand for propionic acid.

The mycological production of citric acid from sugar was observed some 40 years ago. Subsequent research found that the mold aspergillus was responsible for the transformation. The commercialization of the process followed in due course, and at the present time the world's consumption of citric acid is estimated at about 5000 tons per year, the larger percentage of which is, no doubt, the fermentation product.

Some years ago gluconic acid was detected among the products of citric acid forming molds. Later research showed that the mold penicillium effected the formation of gluconic acid in the fermentation process. At the present time the study of the molds and conditions surrounding their production of this acid has resulted in the development of a process which can be trans-

ferred to a larger scale and utilized for commercial production. The chief interest in gluconic acid is centered in its calcium salt, which promises wide application as a source of calcium, both for human and animal needs. Furthermore, gluconic acid has been heretofore known chiefly as the product of a chemical reaction characterized by many objectionable features, with a list price of more than a hundred dollars per pound, and this "new" method will greatly lower the cost and undesirable features involved in the production of the acid.

In the food industries bacteriology and its engineering applications has played quite an indispensable part, as was already noted. The dairy and canning industries, water purification, and the pasteurization of various necessary foods have all seen the effect of this science in their growth.

In the daily industry newer and more scientific methods for the pasteurization of milk (which has for its main purpose, as the reader no doubt knows, the destruction of tuberculosis bacteria) have been and are constantly being developed. At the present time a device for electrical pasteurization, known as the "Electro-pure Process," is being utilized on a commercial scale. The method consists in allowing an alternating current of electricity to pass through a column of milk so that the temperature of the latter, because of its resistance to the current, rises. This process is merely a very efficient and easily controlled device for applying heat. There is nothing about the process whereby bacteria are "electrocuted." The particular value of electrical pasteurization lies in the fact that it keeps the milk away from contact with hot heating surfaces.

In butter manufacture it was a laboratory scientist working from the bacteriological standpoint who showed that butter has a more mild and pleasant flavor and keeps much better if the cream is first pasteurized and then churned in contrast to the old time procedure of allowing the cream to sour irregularly and improperly and then to churn it.

The canning industry, in step with the times, has seen modern research lead invariably to the solution of spoilage problems that were "stickers" in the industry for a great many years. The ripe olive and spinach poisonings of 1919 and 1920 are glaring examples of the tragedy of improper sterilization of canned foods. In this case it was discovered that the presence of the organism "Bacillus botulinus" gave rise to a very toxic substance when spoilage occured. The stimulation of research brought about by the catastrophe resulted in more stringent methods of heat penetration and control. The continuous pressure cooker combined with the absolute temperature control occasioned by the development of thermocouple pyrometry, today, gives us more thorough sterilization of canned foods, and repetition of the above "toxic spoilage" is not probable.

Microbiological chemistry is the chemistry of the future, and its engineering applications will be an indispensable feature of our industrial well-being. Most of Nature's growth processes are catalytic, by the action of enzymes. When the chemist or engineer attempts to duplicate them, he takes acres of ground, tons of machinery, the productive labor of hundreds of men to imitate what Nature has done in the stem of the plant or the leaf of the tree, and he too frequently makes a bad job of it. When Nature wishes to synthesize a product she takes a few elements from the soil, calls on the sun and air for aid, and the work is done. Tartaric acid is formed in the grape from the same material from which the dextrose, also found there, is produced, and tartaric acid can also be manufactured from dextrose by a biochemical reaction involving the use of peroxidase from the rye germ. There is undoubtedly a mold or type of bacteria that will do the same work—but the task is to find it and put it to work in the conditions under which it will produce "most happily." Such is the difficult problem of the bacteriological engineer. The future alone holds the answer to his possibilities.

Engineering News

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doors after the cover of darkness has fallen. Only the beam of an automobile headlight is necessary to have the door swing wide, automatically and magically.

A hole, about an inch and a half in diameter, has been drilled in the door and a protective glass covered placed over it. On the inside is a metal tube containing a photoelectric tube, and from this tube wires lead to the amplifying device attached to the wall of the garage. The beam of the headlight penetrates the little glass window and strikes the light-sensitive surface of the photoelectric tube to a degree sufficient to actuate a relay which operates the regular electric door opening mechanism. Pushbutton switches operate the electric door opener during the daylight hours.

Portable Sump Pump

A new portable centrifugal sump pump bearing a number of exclusive features and specially designed for general work requiring fast and effective expulsion of water, oil and other liquids, has just been produced by a large tool company in Cleveland. It is expected to find ready application by the mining industry in shaft sinking and for seepage and drainage. It is adaptable as auxiliary equipment to steam, electric and centrifugal pumps and in dry mines where a few hours a day only are needed for pumping.

Exclusive features of the pump, according to the manufacturers, include unusually economical operation through a material saving in air consumption. It is very compact with a low center of gravity that prevents it from being upset, and has an oil reservoir capacity of unusual size.

New Electric Tachometer

A new type of electric tachometer has been developed for use in aeronautical installations. It consists of a small alternating current generator, a copper oxide rectifier, and a multi-range portable voltmeter. A special coupling transformer insures a linear relationship between revolutions per minute and frequency to which the rectified voltage is in turn proportional. Hence the

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A New Honor System

Prof (taking up quiz paper): "Why quotation marks on this paper?"
Stude: "Courtesy to the man on my left."

"Lips that touch liquor shall never touch mine."
"Your lips?"
"No, my liquor."

"Why did you quit your job?"
"The boss was so bow-legged I fell through his lap."

Dad coming to son's fraternity house: "Does Rogers live here?"
"Sure, carry him in."

Rock-a-by, Baby,
On a tree top—
Don't you fall out—
It's a helluva drop.

It truly must be humiliating for a duck to learn that its first pair of pants are down.

Bank Teller (cashing a prof's check—handing him several old dollar bills): "Hope you're not afraid of microbes."
Prof: "Nope; a microbe couldn't live on this salary."

Prof: "Wake Schultz, will you, Smith?"
Smith: "Aw, do it yourself, you put him to sleep."

A Theoretical Joke

"Where are you going my pretty maid?"
"There are numerous theories, sir," said she.

Angry Wife: "Very well, now I have a Frigidaire—see what you can do about a mechanical stenographer."

She: "If I were you, I wouldn't be so forward."
He: "If you were like me, what a time we'd have."

And we know the man who calls his girl Violet Ray, because she gives him something you can't get through a window-pane.

Be Reasonable

"What shall I do? I'm engaged to a man who says he simply can't bear children."
"Well, you can't expect too much from a husband."

I see by the paper that nine professors and one student were killed in an accident. Poor chap.

Our Lunch "Hour" Solved

Activities or Grades?

Dear Son:
I just read in the paper that students who don't smoke make much better grades than those who do.
Father.

Dear Father:
I have thought about it. But truthfully I would rather make a "B" and have the enjoyment of smoking; in fact I would rather smoke and drink and make a "C." Furthermore, I would rather smoke and drink and neck and make a "D."
Son.

Dear Son:
I'll break your neck if you flunk anything.
Father.

Where Is This?

Prof: "I'm letting you out early today. Please go out quietly so as not to wake the other classes."

Waiter: "Zoup, zoup, sir?"
Diner: "I don't know what you're talking about."
Waiter: "Well, you know what hash is. Well, zoup is looser."

First Stude: "You nit-wit, you can't date that girl. Why, she's as beautiful as a poem."
Second Sleeper: "Poems are made by fools like me."

"Why is a sailboat called a 'she'?"
"Because they both make a better showing in the wind."

Mary had a little lamb—
Which is unconventional,
to say the least.

He: "You look familiar."
She: "Well, I'm not."

"Are you troubled with improper thoughts?"
"Why, no; I rather like them."

"Is that you John?"
"Yeah, m'dear, if 'taint I'm going to 'ply for a divorshe."

Just Visiting

She: "When I don't want a man's attention and he asks me where I live, I tell him I'm just visiting here."
Guettler: "Ha Ha! Excellent; but where do you live?"
She: "I'm just visiting here."

According to a scientist the average human male is four times as strong as the female. With all due respect to the modern girl, we should say that this seems no longer necessary.

The President of Lehigh University says students have changed very little in the past thirty years. This is why parents who have sons and daughters in college worry.

The Supercharging of Gasoline Engines

(*Continued from page 75*)

The vanes are maintained in contact with the false rotor by centrifugal force. By making the beginning of a discharge earlier, this type of compressor may also be operated on the hydraulic cycle.

The centrifugal compressor is used widely on airplane engines and was used on American racing car engines until barred by the changing racing rules. The operation of this compressor is as follows: the gas is first given a high velocity; then, it is slowed down, converting some of the velocity head to pressure head. The parts of the compressor performing these functions are shown in figure 1, c. The gas is admitted to the center of the impeller, A, a disc with vanes perpendicular to its surface and radially disposed. The impeller is rotating at an enormous speed, from 15,000 to 45,000 r.p.m. The gas is hurled outward by centrifugal force and so given a high velocity. In the diffuser, B, the gas is slowed down by gradually increasing the cross section of the passage thru which it is travelling. In this country, Dr. Sanford A. Moss of the General Electric company has done most of the development and design work on the centrifugal compressor.

The problem of how to drive the supercharger is one that has required considerable study. It is still not entirely solved. One method of driving a centrifugal compressor for airplane work is to use a turbine supplied with exhaust gas from the engine. Usually, the exhaust is only taken from perhaps two cylinders. A valve in the line to the turbine allows the gas not required to be discharged directly to the atmosphere. This drive method is not suitable for automotive work because the turbine becomes too hot except at high altitudes where the temperature is very low. An advantage of the exhaust turbine drive is the ease with which the output pressure of the compressor may be regulated. Two disadvantages are: 1) that the back pressure of the exhaust is increased, and 2) that the turbine is subject to such high temperatures as to invite failure. The ordinary supercharger drive is by means of gears, or directly, from the end of the crankshaft. In airplane engines, the drive is by gear from the anti-propeller end of the crankshaft, and as a centrifugal compressor is commonly used, a considerable step up thru the gears is necessary. In automobile engines, the drive may be taken either thru gears from the crankshaft or direct. I know of two cases of the use of a clutch between the crankshaft and the gear train or supercharger. The clutch enables the supercharger to be used at will.

If the supercharger is placed before the carburetor, certain alterations must be made. The carburetor, as it operates under pressure, must be provided with an internal venting system so that the pressure at the inlet to the carburetor will be transmitted to the top of the float chamber; otherwise, no gasoline will be sprayed into the air stream. The fuel feed system to the carburetor must be designed to work against this pressure.

In most cases of the compression of gases, the temperature of the gas is raised. This decreases the density of the gas for a given pressure. This effect with most superchargers is not great enough to require any measures to avoid it. The weight of charge delivered to the cylinder will not be greatly decreased. In special cases, however, such as with great increases in pressure, it becomes necessary to cool the gas after compression. One method of accomplishing this is to pass the gas through thin-walled tubes exposed to a draft of cool air. Intercoolers of this and similar types were widely used on the 91.5 cubic inch Indianapolis type racing cars. The output pressure of the supercharger on such a car was around 28 pounds per square inch absolute.

I will now describe some supercharger installations, attempting to choose some of the more typical ones.

Rolls-Royce fit superchargers to several of their airplane engines. In fact, the supercharged Model R. figure two holds the world's speed record for aircraft. Until very recently, the speed record on the water was also held by the "Miss English II" using two of these engines The "Miss England III," now in progress of construction will use this same model. The engine is a V-12 of 6″ bore and 6.6″ stroke, developing 1900 brake horsepower at 3000 r.p.m. with a pressure of 12 pounds per square inch, gauge, on the supercharger. The weight is 1530 pounds. The supercharger is of the geared centrifugal type.

The Rolls-Royce "Kestrel" is similar in general design to the model R. The engine is a V-12 of 5″ bore and 5.5″ stroke. As the same engine is put out in four different forms, comparisons may be drawn. The cylinder construction is of the wet sleeve type. There are four valves per cylinder, actuated by an overhead camshaft and light rockers. The camshaft on each bank of cylinders is driven by bevel gears and shafts which are driven by bevel gears on a short vertical shaft driven in turn from bevel gears from the crankshaft. On supercharged engines, the centrifugal blower is located at the anti-propellor end of the engine in line with the crankshaft. The impeller is driven by a gear train from the crankshaft. The step up is 1:6.9 in the case of moderately supercharged engines and 1:10 for "fully" supercharged engines. Incorporated in the gear train is a friction device to protect the gears from injury in case of sudden acceleration or deceleration of the engine. The inertia of the impeller at high speeds would impose a heavy load on the gears under these conditions. As the friction drive is set to slip at a given torque, the gears are protected. The supercharger is arranged to draw the mixture from the carburetor. In figure two, the pipe leading to the inlet of the carburetor is an intake pipe for the carburetor and faces the slipstream from the propellor. The performance of the "Kestrels" is as follows:

Unsupercharged IA, IIA, IIIA.
Normal BHP at ground level:
490 at 2250 r.p.m.
Maximum BHP at maximum r.p.m.
560 at 2700 r.p.m.
Compression ratio—6.0:1.
Fuel consumption—30 gal. per hr.
Weight of engine—884 pounds.
Unsupercharged IB, IIB, IIIB.
Normal BHP at ground level.
480 at 2250 r.p.m.

The Supercharging of Gasoline Engines

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Normal BHP at 3000 feet.
480 at 2250 r.p.m.
Maximum BHP at maximum r.p.m.
580 at 2700 r.p.m.
Compression ratio—7.0:1.
Fuel consumption—28 gal. per hr.
Weight of engine—884 lb.

Moderately supercharged IMS, IIMS, IIIMS.
Normal BHP at ground level.
525 at 2250 r.p.m.
Normal BHP at 3000 feet.
500 at 2250 r.p.m.
Maximum BHP at maximum r.p.m.
660 at 2700 r.p.m.
Compression ratio—5.5:1.
Fuel consumption—35.0 gal. per hr.
Weight of engine—922 pounds.

10,000 feet supercharged IS, IIS, IIIS.
Not operated full-throttle at low altitudes.
Normal BHP at 11,500 feet.
480 at 2250 r.p.m.
Maximum BHP at maximum r.p.m.
580 at 2700 r.p.m.
Compression ratio—6.0:1.
Fuel consumption—32 gal. per hr.
Weight of engine—922 pounds.

Note: The numerals I, II, and III refer to the gear reduction of the propellor.

The supercharger apparently costs, in increased fuel consumption and slightly increased weight but the horsepower increase at ground level or the maintenance of horsepower at an altitude makes the supercharged engine very desirable for many special purposes such as in flying boats and in military planes.

All engines with centrifugal superchargers after the carburetor enjoy one pronounced advantage; the supercharger thoroughly mixes and breaks up the fuel in the air stream, giving a very homogeneous mixture. This action is occasioned by the impeller.

An engine which takes full advantage of the mixing effect of the centrifugal supercharger is the Pratt and Whitney "Wasp." This engine is of the radial air-cooled type. There are nine cylinders of 5.75″ bore and 5.75″ stroke. The supercharger is located at the anti-propellor end of the crankshaft and is driven by a gear train from the crankshaft. The supercharger is located between the carburetor and the engine. The inlet pipes to the cylinders are taken off from the section surrounding the diffuser. There are nine separate inlet pipes, leaving the collecting section at equal intervals. Each cylinder is thus at an equal distance from the carburetor and each receives the same quality of mixture. The mixing effect of the supercharger insures a uniform mixture. This type of induction system is chiefly used for distribution purposes, but there is an appreciable supercharge as about 3.5 inches of mercury pressure, gauge, is obtained at the blower outlet. By increasing the step up of the gear train, a greater amount of supercharge can be effected and this is done for special purposes.

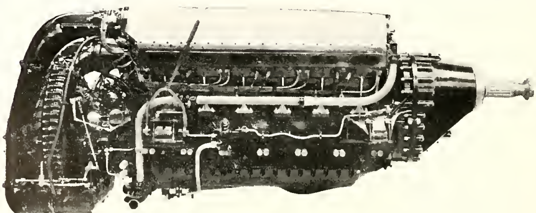
Mercedes-Benz, the earliest sponsor of passenger car supercharging, build sports cars so equipped. The engine is a six of the overhead-valve, overhead-camshaft type. The supercharger, of the Roots blower type, is mounted with its axis vertical at the front of the engine. The drive is through a disc clutch on the crankshaft to bevel gears driving the blower. The step up is 1:3. The engine ordinarily runs without the supercharger. When it is desired to make a high-speed sprint or to accelerate rapidly, the accelerator is depressed past the full throttle position, against a strong spring. This action engages the supercharger clutch and closes the connection of the carburetor to the outside air. The carburetor thus is under pressure. The float chamber of the carburetor is sealed and connected to the intake of the carburetor to maintain the proper pressure. The fuel supply is by vacuum tank, the tank being of great capacity. While the supercharger is in use, the vacuum tank is, of course, under pressure, and the engine runs on the tank contents, no fuel being drawn from the gasoline tank. The performance of one of the older models is shown in the accompanying table.

Bentley (England) put out a four cylinder sports car, some models of which are fitted with a Roots blower. The blower is driven from the crankshaft directly, being mounted between the frame horns, in front of the radiator. The blower sucks the mixture from two carburetors mounted on its intake port. A relief valve on the intake pipe leading to the intake manifold protects the blower against backfiring. The performance of both the supercharged and unsupercharged cars is shown in the table, for comparison.

Lagonda and Lea-Francis equip four cylinder sports cars with vane type superchargers, the installations of which are similar. The compressors are mounted vertically at the front of the engines, being driven by bevel gears from the crankshaft. The carburetors are mounted at the intake of the compressors. In fairness to the Lea-Francis, it must be noted that the car tested was a fabric-bodied coupe. The two passenger sports car will accelerate from 10 to 30 miles an hour in four seconds in first gear.

Acceleration figures given are from road tests of the "Autocar."

Taking a broad view of supercharging, some general observations as to the facts of the case may be made. For airplane work, the centrifugal compressor is most widely used. It is sometimes



Courtesy—Rolls-Royce Ltd.

Above is shown one model of a Rolls Royce Engine.

exhaust turbine driven but more often gear driven. The mixing effect of the centrifugal compressor is highly desirable. The centrifugal supercharger is used in several different ways. On commercial radial air-cooled engines, it is used as a distributing device. It is frequently used to maintain sea-level power of engines to some moderate altitude. On racing airplane engines, the centrifugal supercharger is used to maintain volumetric efficiency and mean effective pressure at high engine speeds. For experimental and military aircraft, it is used to increase the ceiling and high altitude performance. For automotive work, positive displacement superchargers of the Roots and vane types are more widely used. They are employed to maintain volumetric efficiency and mean effective pressure at high engine speeds and to increase the accelerating ability of the cars. The supercharger is not widely used except on sports and racing cars. It is usually used continuously, though some installations provide for its use only when needed.

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voltimeter indication is a linear function of the speed.

Commutators, collector rings, and brushes are eliminated in the generator circuit by designing this unit of a small, rotating, toothed steel core and a permanent magnet for excitation around which the armature coils are placed. This electric tachometer is superior to those of the mechanical type in that: (1) no gear box is employed, allowing for rapid change of ranges. (2) the instrument deflection is always positive, (3) the indication is the same regardless of direction of rotation. It is expected that these advantages will make the instrument a popular one for speed measurements.

Carrier-Wave Power Transmission

Superimposing one electric current upon another, has led to a method of controlling the operation of street lights and of electric water heaters by making use of the same service wires that supply the lighting and heating current. The wire actually possesses the ability to transmit simultaneously three or more electric currents of different characteristics. These currents do not interfere with each other, but, on the contrary, find plenty of elbow room within the thin strand of copper.

Turning on and off street lights, domestic water heaters, sign lights and show-window lighting; conveying spoken words and printed messages; setting instruments to read exactly the same as other instruments hundreds of miles away—even reproducing by television, the entire instrument board of an outlying station on a screen in front of the power dispatcher's desk — all these widely different carrier-currents appear capable of jumping on and jumping off the same wires which run motors and light lamps. Some of these miracles are already here; others appear to be just around the corner.

In the new control for street lights and off-peak loads, only two currents are transmitted sim-

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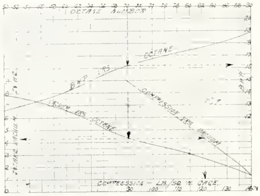
Detonation of Multiple Cylinder Engines

(Continued from page 69)

depression and evaluate the knock intensity of all the fuels. The loci are in a vertical line of 5.1 In. Hg. manifold depression. A second series of tests was then made with the throttle adjusted to a uniform knock intensity of 0.875 units. Fuel No. 5 would not give this knock intensity even at wide open throttle (1.1 In. Hg.). The corresponding knock was 0.675 units. The two points obtained for each fuel were connected by a straight line which is obviously arbitrary. The close proximity of the two points for some of the fuels is also subject to criticism. However, the data illustrate the specific method of presenting this test procedure. The method is in reality a combination of fixed throttle with variable knock and fixed knock intensity with variable throttle.

The practical rating of the anti-knock value of an unknown fuel has been greatly simplified by the recent general use of blends of octane and heptane as yardsticks. These two fuels were proposed by Dr. Graham Edgar of the Ethyl Gasoline Corporation and have been adopted by the Detonation Sub Committee of the Cooperative Fuel Research Committee. This Sub-Committee has greatly advanced matters of information pertaining to anti-knock measurements. The current literature of the Society of Automotive Engineers, Incorporated,—the American Petroleum Institute and various periodicals have described the work of this Sub-Committee as new phases of the work have developed.

Octane (2, 2, 4—trimethyl pentane) has the ability to operate without detonation at higher compression pressures than any compression in commercial use today. Normal heptane requires a lower compression pressure for operation without detonation than even the lowest compression in commercial use today. Blends of octane and heptane may be made to match the detonating characteristics of any of the various commercial fuels in use today. The equivalent blend in terms of percent by volume of octane is termed the octane number of the fuel. Due to high cost of these two standards it is not practical to make all tests by matching directly. Reference curves are therefore often established or secondary reference fuels with carefully determined octane ratings are used for routine test work. The most widely distributed series of secondary standards are those prepared by the Standard Oil Development Company with ratings of 50 octane for the "A" Standard, 67.5 octane for the "B" Standards, and 82.8 octane for the "C" Standard.



Reference curves showing the octane number of mixtures of these three fuels have been carefully prepared under prescribed engine conditions and technique. Other similar curves show the octane number of the reference fuels when used with benzine or lead tetra-ethyl admixtures. These form a very valuable measuring stick for direct matching of fuels and naturally must be used under the prescribed engine conditions or technique. When used under other conditions some changes in octane numbers may be expected based on their direct comparison with octane heptane blends at the new conditions. Other reference fuels may be established provided adequate consideration is given to stability of the product over the period in which it is used and to its being a representative fuel in physical properties.

The conversion of the relative data, as showing in Figures 1 to 5 inclusive, into octane numbers requires sufficient runs made with various octane blends (or with calibrated reference fuels) so that the data as observed may be interpolated or bracketed. In Figure 1, one fuel of known octane number and slightly better than the sample and a second fuel with a slightly lower and known octane number than the sample may be run and the octane number of the sample then determined by inspection. In practice a series of reference fuels varying by 5 to 10 octane numbers may be placed on the chart and any unknown sample ploted and its octane number determined by this method of test. Figure No. 4 shows seven different unknown samples plotted on stepped scales of sound intensity. Vertical lines may be used for the octane scale, and approximate values for this chart would be 60 octane at the 12 degree line and 72 octane at the 20 degree line. The two commercial non-premium fuels Nos. 1 and 2 have approximately 60 octane rating under the audibility spark-advance method of test while using a sound intensity of 2.5 units (distinctly audible). The two commercial premium fuels Nos. 3 and 7 have approximately 70 and 74 octane ratings. The aircraft fuel No. 4 has approximately 65 octane rating. Fuel No. 5 represents a cracked fuel of about 80 octane rating and is suitable for blending stock. The benzol blend is approximately 77 octane rating.

Figures Nos. 2 and 3 show a characteristic knock curve obtained by gradually closing the throttle when operating with a given fuel. It is to be noted that the knock intensity at first increases and then falls. This effect is objectionable when using a part throttle for knock measurements. It is probably caused by a combination effect of various conditions some of which may be as follows:—

Some engines have been observed in A.I.T. Automotive Laboratory Tests with a balanced diaphragm indicator, to maintain or even increase the compression pressure as the throttle is closed slightly from a wide open position. The changes are probably due to improved ramming effect at the late closing intake point in the cycle. Increased compression will, of course, give increased detonation but it is believed that the magnitude of the sound increase is greater than can be attributed to this cause alone. Other influences being equal, engines with the minimum disturbance at this point will be better for knock test work. Curves shown later show compression pressure versus intake manifold depression which have only slight linear deviation. (See Figures 6 and 7).

It appears very likely that the small initial increase in detonation as the throttle is closed may also be influenced by the relation of residual hot gases to the new charge. This is a temperature effect.

The small peak may also be influenced by the baffling action of the butterfly valve and its effect on the mixture condition producing stratified mixtures of greater knocking tendencies.

Figure No. 5 shows various fuels of approximately the octane ratings as used in Figure No. 4 except that Fuel No. 6, the benzol blend, has a lower octane rating approximately equal to Fuel No. 3. The data as shown shows relative ratings only. If it is desired to convert these into octane ratings various standard octane/heptane blends or reference fuels differing by 5 or 10 octane numbers may be plotted on the same sheet and the ratings of the unknowns obtained by interpolation. This method is better shown in Figures Nos. 6 and 7 in which reference fuels differing by 5 octane numbers were used to establish the curves. A careful selection of the compression pressure and engine operating conditions permits fuels from 50 to 90 octane numbers to be tested. It is apparent that this method of testing represents car operating conditions in which the driver operates at the maximum throttle which gives a specific permissible knock.

These two charts were made with a 6.5 to 1 volume ratio engine operating at 1000 R.P.M. and fitted with a conventional manifold hot-spot. The air entering the carburetor and the outlet jacket water temperatures were maintained at 160 deg. Fahr. and the oil in the engine sump was 130 deg. Fahr. The spark advance was 13 degrees early for Chart No. 6 and 14 early for Chart No. 7. This is at the peak of the spark advance curve when operating at wide open throttle. The sound intensity was maintained constant as indicated by a Burgess Acoustimeter operating at 2000+ frequency acceptances. For the Chart No. 7 this was equivalent to slightly more than an incipient knock while for Chart No. 6 the sound intensity was equivalent to a very noticeable knock. The first was A+ and the second B+ on an arbitrary scale of A, B, C, and D knock intensities established in this laboratory. "A" represents incipient knock and "D" a very severe knock.

A casual inspection of the two charts shows that Chart No. 7 extends the range of fuels tested to higher octane numbers. The initial peak of the detonation increase with closing of the throttle is not present in these tests and makes for a more satisfactory analysis.

This reference chart may be used for the determination of the octane rating of unknown samples by determining the vacuum and B.Hp. developed by the sample. This is illustrated by the dotted lines. On Figure No. 6 if the sample showed 2.1 In. Hg. of manifold depression, the corresponding compression pressure would be 135 lb. per sq. in.—the B.Hp. would be 18.6 and the octane rating 70.

Designing The Modern Skyscraper

(*Continued from page 72*)

court walls as well as the floor loads were carried by the frame work. In 1887-88, the Tacoma Building took shape. Holabird and Roche were the architects of the twelve and later fourteen story edifice, probably the first complete type of skeleton construction. And then the first twenty-story building, the Masonic Temple, was erected in Chicago in 1890.

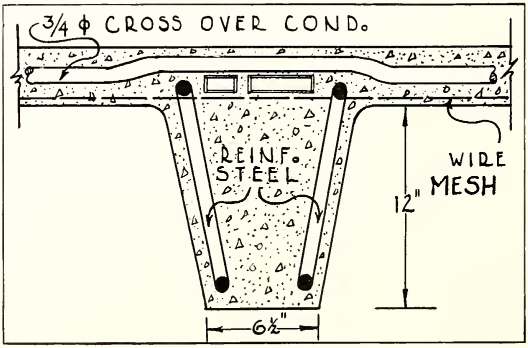
Along with the development of materials and fire-proofing construction, great strides were being taken by mechanical engineers and manufacturers in perfecting the passenger elevator for rapid transit. Prior to 1870, passenger elevators were virtually unknown. To walk, or rather labor, twenty to thirty flights of stairs to attain your goal was nothing short of torture. One of the earliest of elevators for passengers was that used in the Fifth Avenue Hotel in New York City. It was operated by means of a vertical iron screw, this passing through a sleeve in the center of the car. Rather slow and inefficient, don't you think? It would have been somewhat embarrassing, to a few people at any rate, if the iron screw had slipped! Steam and hydraulic elevators were later developed, until the modern electric type was perfected.

Recently two important skyscrapers have been erected. One is the Colgate-Palmolive-Peet Company's building, more commonly known as the Palmolive Building. This structure, which has a frontage of 172 feet on Michigan Avenue and 231 feet on Walton Place, rises for 38 stories to a height of 468 feet, 6 inches, and terminates in a beacon light at a point 620 feet above the sidewalk. Below the sidewalk grade, the basement, first and second sub-basements, and the boiler room extend to a depth of 36 feet. The building is, of course, of fireproof construction throughout, the steel frame resting on caissons carried down to bedrock. The roofs, floors, etc., are of reinforced concrete. Every latest mode of construction, together with the finest of materials, is employed in its erection, insuring permanence and safety. The maximum amount of daylight is assured by the plan shape at the various levels, and the diminishing size of the floor plan admits of the possibility of the rental of entire floors with varying space requirements, as illustrated by this table of areas:

First Floor	15,885 square feet
2nd to 10th	11,850 square feet
11th to 16th	10,500 square feet
17th to 21st	5,800 square feet
22nd to 32nd	4,100 square feet
33rd & 34th	3,842 square feet
35th & 36th	3,196 square feet
37th	2,914 square feet

The second important building of present design is that of the Chicago Daily News. The structural frame of the building is of steel, and the typical floor construction throughout the office portion of the structure is of the concrete joist slab (flat) type. This is formed by the use of thirty inch pans, as illustrated. The building is partly over the railroad tracks of the Chicago, Milwaukee, St. Paul and Pacific Railroad. Due to its relation to the tracks, the steel frame has some particularly interesting features. In many cases, very large double plate girders were used as cantilevers over the tracks. These were used to support the heaviest loads. Some of them ran as high as 12 feet in depth. In one instance the moment on one of these mammoth beams was 56 million foot-pounds. Smaller girders carrying the lighter loads were attached to these cantilevers and spanned the remaining distance between the columns. Because of the restricted headroom dictated by the clearance above the tracks, it was necessary to use pin connections for this purpose. This was true, though, only in some cases. In one particular instance in the structure, a truss supports, on its top chord, a roof, and from this same truss floors of the building are suspended. The bottom chord of this truss alone weighed 65 tons. It required only two hours for its erection. This was the maximum time that could be given as it was put in place above the tracks and consequently could not be allowed to interfere with the train service. The rest of the truss was simply erected in place over the bottom chord.

In all buildings of importance nowadays, a very close contact is maintained between the architect and the structural engineer. Matters must be settled as to the correct spacing and location of all columns to provide correct arrangement and size of elevator hatchways and elevator entrances. These problems must be considered on the basis that the vertical transportation in high buildings is of primary importance, and that all other arrangements, both of structural and architectural design, must be made to conform to the best possible elevator installation. An accurate schedule of location of all mechanical equipment and the weights thereof, must be furnished the structural engineer, and in addition, the detail of all vertical pipe shafts, conduit shafts, and ventilating shafts. In no case is it advisable to pierce any of the structural steel mem-



Section of a joist used in The Chicago Daily News Building.

bers for the convenience of pipe lines or ventilating ducts.

The American skyscraper, considering it as a type of building, represents a style of American architecture. At one time its commercial growth, beyond a certain limitation, seemed well nigh impossible. In the early skyscrapers commercialism seemed to have won out radically. It had made some little concessions to architecture, perhaps, allowing of a certain introduction of architectural motives here and there, which forecast the possibility of further concessions. But the earliest skyscrapers were actually nothing more than an elongated box; the design lacked any structural significance. That was the first skyscraper. Knowing it, one will better understand and appreciate the strides made during the last twenty years in its further development. For from this as a nucleus we have developed the modern skyscraper.

Thus, we may then describe the various stages in the development of the skyscraper as, first, the box; second, the all-over design box; third, the surmounted or combined tower; fourth, the tower; fifth, the massed tower; sixth, the set back. These designations must not be considered too literally. They represent, as well as any other method, probably, the steps by which the pinnacle was attained. It must not be understood, however, that the earlier types passed out of existence with the introduction of a new idea. But at this present day commercialism and art have actually smoothed out all differences, and skyscraper architecture has attained its goal.

A New Development Plan For Engineering Education

(Continued from page 71)

the progress of alumni in commerce and industry so that the fund of knowledge thus assembled may be drawn upon as a critique of educational policy throughout.

Other institutions will be associated with the college of science, engineering, and architecture. An industrial research institute will be established as an adjunct of the college. It will be organized to do intensified industrial research work for industry. Fellows for its staff will be selected from the graduate schools as they complete their education in research methods. As it is planned now, only applied research work will be done.

A technical institute will be organized as another adjunct of the college. In such an institute artisan, technical, and supervisory staffs of industry will be given training. The training offered will be for callings which occupy a place between the skilled crafts and the highly scientific professions.

One important external feature of the new school provides the means of establishing that close co-operation with industry which will be maintained throughout. Most prominent industrialists and professional men believe engineering colleges lose ground because they cannot translate the fast evolving needs of industry in terms of curriculum and teaching methods. Industry, on its own initiative, rarely makes well defined and organized statements of its needs, and faculties have little or no authoritative data upon which to work.

Therefore, one of the most significant elements of the whole development plan is the organization of a permanent industrial relations committee to be composed of outstanding industrialists and professional men. This committee will be related to the permanent faculty committee on educational policy and the personnel and placement department within the Institute. Industrialists and professional men, through organized representation, will therefore take a part in the formation of educational policy. Thus, the college of science and engineering, its alumni, the technical institute, the professional societies, and industries will form a mutually beneficial partnership for the greater advancement of technological education and training in the Chicago industrial area.

These are a few of the major resolutions of the new development plan for Armour Institute of Technology. It has been forged together, link by link. It seeks, above all, to create genuine values. Through the instrumentality of this plan, a great structure is designed to meet the needs of industry . . . designed to be even more useful to individual boys and men.

In creating a great science and engineering center, the plan becomes a vital part of Mid-Western industry. Industrialists, educators, and professional men of national repute who have assisted in making the plan have stated that it unquestionably will command the attention and win the cooperation and material support needed to make it a reality.

Many of the changes and improvements which the plan calls for can be effected progressively. The usual procedure of obtaining funds first to launch untested expansion can be reversed. Improvement will be introduced on a test basis, and when a change in policy or method is demonstrably sound, professional and industrial men, who will have been active in proving and trying its soundness, will assist in providing the funds for its installation. Thus, the plan provides in itself a means of judging and evaluating its own methods, and thus will its ambition always be adjusted to the purpose for which it has been made.

By making a careful selection of the men who are to receive its advantages, by giving them an education which embraces the fundamentals of scientific thought as well as a study of the broad fields of human understanding, by creating for them the opportunity to serve in any of the positions in which a knowledge of engineering is essential, and by keeping in close touch with the life into which it is sending these men—in all these ways does the development plan for Armour Institute of Technology recognize the importance of engineering in modern life, and in every detail of each of these functions will it be governed by its guiding philosophy of usefulness.

Engineering News

(Continued from page 91)

ultaneously. These are the regular continuous supply current for heat, light and power, and one of the control currents, or carrier currents. These control currents have much higher electric frequencies than the service current, which usually is 60-cycle alternating current. The control current for street lights is of 480 cycles, and that for controlling water heaters 720 cycles. The control currents pass over the wire for very brief periods, only long enough to actuate the control devices, but there is no reason why such currents cannot flow steadily if required.

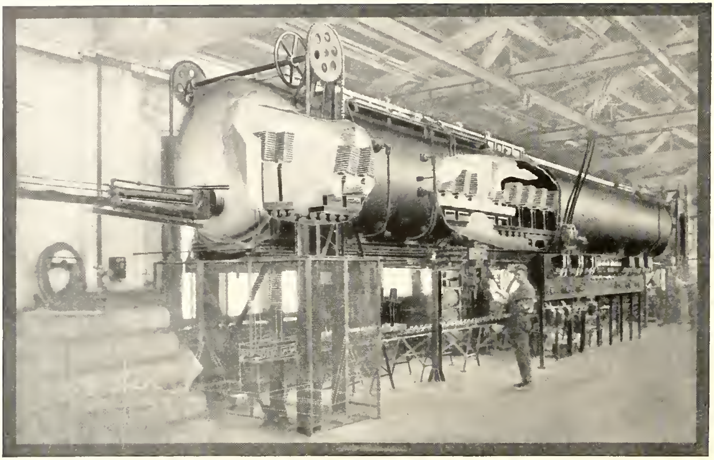
Already the control system is in use at Springfield, Mass., controlling 80 street lights without the necessity of using a separate circuit for the control mechanism, hence making possible a pronounced saving. The double control method, employing currents of two frequencies, is already so practical that it is suitable for general utility purposes.

Water heaters of the type included in this system are supplied with heating current during night hours when the demand upon electric lines is the lightest. Thus the operator at the distribution power station can control a multitude of water heaters.

A Portable Electric Fever-Producing Machine

A portable electric fever-producing machine that makes it possible to raise the internal temperature of special body-parts, of arm and leg joints, for example, without producing a complete fever-temperature was shown to members of the New York Electrical Society at the science forum, December 16, in the Engineering Auditorium, New York. The meeting devoted to "Electricity in Modern Medicine," included a number of papers describing new electric equipment for medical uses.

The machine shown at the meeting was similar to, but smaller than, the high-frequency converter announced last year, which is being used in numerous hospitals and medical schools for investigations of the value of internal heat in the treatment of various diseases.



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These developments in industrial heating are largely the achievements of college-trained General Electric engineers. Newly graduated young men obtain in the Testing Department practical experience which fits them for future positions of responsibility.

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The ARMOUR ENGINEER

MAY, 1932
VOLUME XXIII
NO. 4

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Published Quarterly by the College of Engineering

ARMOUR INSTITUTE OF TECHNOLOGY

Volume XXIII May, 1932 Number 4

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The Chicago Avenue Pumping Station—A Night View

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The Explosive Limits of Petroleum Vapors

By Jarl T. Sorensen, '33

Student in the Department of Fire Protection Engineering

EDITOR'S NOTE: *The petroleum industry has become one of civilization's great factors; the uses of its products have increased manifold. In most refineries explosions and fires are only too common, and have cost many lives and the loss of much equipment and product. It is thought that a proper utilization of the data referred to in this article will do much to decrease the great annual losses in life and property suffered by the petroleum industry through the invisible explosive vapor hazard.*

A KNOWLEDGE of the explosive limits (or limits of inflammability) of gasoline and other hydrocarbon vapors in air is of very great importance in the prevention of explosions and fires in the petroleum and related industries. Also, methods of determining the content of gasoline vapor in such mixtures are essential in ascertaining the risks involved in the storage and use of gasoline. Explosive vapor spaces within tanks are probably the worst single item among oil fire hazards. Most oil fires begin with an explosion, or are spread by vapor explosions. Even if highly inflammable oils are severely heated, if there is no air supply, the contents are reasonably safe from combustion.

An inflammable mixture of gases or vapors may be diluted with one or another of its constituents until it is no longer inflammable. The dilution limit of inflammability is the border-line composition; a slight change in one direction produces an explosive mixture, in the other direction a non-explosive mixture. There are clearly two limits of inflammability, a higher and a lower, for each pair of so-called combustible vapor and supporter of combustion. The lower limit corresponds to the minimum amount of vapor, the higher or upper limit to the maximum amount of vapor capable of conferring an explosive quality on the mixture. Vapors within these limits liberate enough energy on combustion of any one layer to ignite the neighboring layer of unburned mixture and are therefore capable of self propagation of flame; others are not.

Petroleum is a complex mixture of many different combustible hydrocarbons of widely varying boiling points. It is obvious that combustible vapors are therefore always present, and prevention of explosions can only be accomplished by maintaining the combustible vapors in such proportions as to be non-explosive, even if ignition sources are present.

The lighter combustible vapors from petroleum and its products consist largely of saturated hydrocarbons, and each individual hydrocarbon vapor has a different explosive limit. It therefore becomes necessary to know what hydrocarbon vapors may be present before the explosive limits can be foretold.

It is known what is the predominating hydrocarbon content and the percentages of gases and vapors liberated by petroleum and its products from storage tanks, tankers, and similar places. These tables also give the average number of carbon atoms per molecule in the vapor. This does not mean that the values given are the only gases or vapors present, but rather the average of those present. For example: Mid-Continent crude oil with the vapor sampled one foot above the oil level indicates four carbon atoms to the molecule or butane. This is the average composition given by analysis. Separation of the vapors into the individual constituents would have revealed the presence of ethane, propane, pentane and others.

Results show that the vapors having ten or more carbon atoms per molecule are never present in sufficient quantities at ordinary temperatures to produce explosive mixtures. The average number of carbon atoms in the molecule must be eight or less for the hydrocarbon vapors to have sufficient vapor pressure to produce explosive mixtures at temperatures less than 100° F.

There are certain factors affecting the limits of inflammability

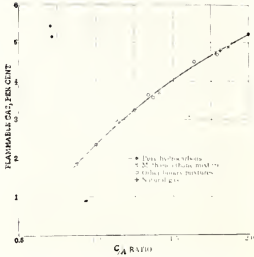
[illegible] must be mentioned in order [illegible] the subject may be under[illegible].

When a heat source of sufficient size and intensity is introduced into a mixture below the lower explosive limit, some combustion occurs even when the mixture is incapable of self-propagation of flame. This usually is visible as a "cap" of flame which may be large if the source of heat is ample. An intense source of ignition introduced into the mixture capable of propagating flame will produce a larger cap than a weaker source. Aside from this, the source of ignition has no effect on the observations when the tests are carried out in an apparatus of proper size. The true test of an explosive mixture is whether or not it continues to propagate flame after the influence of the ignition source has been dissipated.

There is a difference in the explosive limits, depending on the direction in which the flame is propagated. When a source of ignition, such as a flame, is introduced into an inflammable mixture, flame tends to travel away from the source in all directions. In a very large volume of mixture the form of the combustion zone would be a spherical shell of increasing radius, were it not that the hot expanded products of combustion tend to rise and hence to introduce convection currents. Flame cannot travel downward when the upward movement of the gases, due to convection, is faster than the speed of flame in a still mixture, as happens in weak mixtures near the limits of inflammability. Hence, near each limit there is a range of mixtures which will propagate flame upward but not downward. These should be considered as explosive mixtures, since if they are ignited near their lower confines, flame will propagate entirely through the mixture to the top. The limit for upward propagation may be considered safe, because if mixtures do not propagate flame in this direction, they may be considered safe for all other directions of flame propagation.

As the propagation of flame depends on the transfer of energy from the burned to the neighboring unburned layer of gas, and as in a limit mixture the amount of energy available for transfer is only just enough for maintenance of flame propagation, anything that reduces the available energy will affect the limits. Hence, it is necessary to make observations in vessels which are so wide that the cooling effect of their walls is negligible. Also, the vessel must be long enough for the observer to ascertain whether the flame continues to propagate after the initial impulse from the igniting source has dissipated. The observed limits of inflammability widen as the width increases, more rapidly at first, and very slowly at a later stage.

Normal variations of temperature and pressure have no appreciable effect on the explosive limits. Larger variations in pressure have neither simple nor uniform effects; it is specific for each inflammable mixture. A great reduction in the pressure tends toward a narrowing of the range of inflammability, indeed, as the degree of vacuity increases, the limits coincide; below this point



The above curve gives the lower limits of inflammability of various petroleum vapors.

no mixture is capable of propagating flame.

Few observations have been made of the effect of turbulence on limits of inflammability, but it has been shown that the lower limits are somewhat reduced. Turbulence may be imparted by means of a fan, or by stream movements of the mixture.

There are a number of types of apparatus in use to determine values of upper and lower explosive limits of specific vapor mixtures. Most commonly used, is one embodying a vertical glass tube, six feet long, and two inches diameter. This is sealed at the bottom with a glass plate and a mercury envelope, and it is from here that the gas mixture is ignited. Glass shell tubing, fused to the top, leads past a manometer to a calcium chloride drying tube. Three way T-bore capillary stopcocks connected at each end of the drying tube, and an extension to another drying tower and Hi-Vac pump complete the assembly. By proper evacuation the test mix-

1	2	3	4	5	6	7	8	9	10	11	12
Hydrocarbons	Formula	Molecular weight	Chemical reaction when burned with oxygen (air)	Volumes required for complete combustion		Products of combustion per volume of gas burned			Contraction produced when one volume of gas is burned	Explosive limits in air	
				O_2	Air	CO_2	H_2O vapor	N_2		Lower	Higher
[illegible]	[illegible]	[illegible]	[illegible]	2.0	[illegible]	1.0	2.0	7.56	2.0	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	3.5	16.72	2.0	3.0	13.23	2.5	3.2	12.5
[illegible]	[illegible]	[illegible]	[illegible]	5.0	23.89	3.0	4.0	18.90	3.0	2.4	9.5
[illegible]	[illegible]	[illegible]	[illegible]	6.5	31.06	4.0	5.0	24.57	3.5	1.9	8.5
[illegible]	[illegible]	[illegible]	[illegible]	8.0	38.22	5.0	6.0	30.24	4.0	1.1	8.0
[illegible]	[illegible]	[illegible]	[illegible]	9.5	45.39	6.0	7.0	35.91	4.5	1.3	
[illegible]	[illegible]	[illegible]	[illegible]	11.0	52.56	7.0	8.0	41.58	5.0	1.1	
[illegible]	[illegible]	[illegible]	[illegible]	12.5	59.72	8.0	9.0	47.25	5.5	1.0	—

[illegible] Limits of Inflammability of Gases and Vapors, by H. F. Coward and G. W. Jones, for original references [illegible]

Courtesy—National Fire Protection Ass'n

This table gives combustion data of hydrocarbon gases existing in petroleum vapors.

ture in the tube is held at exactly atmospheric pressure, and then ignited with an alcohol flame. That vapor content which just propagated flame to the top was then taken as the limit mixture.

As the predominating hydrocarbons vary from ethane to heptane, it is seen that the lower and higher explosive limits may range from about 1.1 to 12.5 per cent by volume for petroleum vapors in air. Unless the average carbon content of the vapors is known, the gases should be considered flammable if the amounts of combustible vapor lie within the limits given above.

If means of analyzing the gas mixtures in a given space are available, the lower limit can be closely calculated from this analysis alone. In such an analysis as mentioned here, the combustible is burned in an excess of oxygen, and the contraction due to the burning is noted and the carbon dioxide produced is also determined. The ratio of this contraction to the carbon dioxide produced can be used for determining the lower explosive limits of the mixture, as is shown on the accompanying curve. This curve was obtained experimentally by Coward and others, and shows that calculated and determined values check closely for all saturated hydrocarbons tested.

Although the exact lower and upper explosive limits may be known for the individual constituent vapors and for the predominating hydrocarbon content of various petroleum vapors as expressed by the average carbon atom content per molecule, yet, this knowledge is not sufficient to protect the industry. The inflammable vapor hazard is particularly insidious because there has been no convenient method of detecting or measuring it. Wherever flammable liquids are used or stored there is always the potential hazard of fire or explosion of the vapor, but with methods heretofore available it is often a very difficult matter to determine whether or not flammable vapors are present in dangerous quantities. The sense of smell cannot be depended upon to differentiate between a safe and an unsafe atmosphere, and chemical analysis is a slow and laborious process. Recent developments have made available a number of instruments capable of quickly and conveniently determining the percentage of flammable vapors present, and should be of very great value in controlling the fire and explosion hazard, in regulating ventilation to maintain a safe atmosphere, and in determining that large oil tanks are in a safe condition for repair operations. A number of different instruments of the same general character have been independently developed, and I will briefly describe one of these, the gasoline vapor indicator developed by the Standard Oil Company of California. This device, as all others perfected, depends upon the heating effect due to the burning of a small sample of the atmosphere under analysis, this heating effect being measured electrically and giving a reading on a dial. The description will indicate the compact simplicity of the apparatus.

A hose leading to the point where the analysis is desired is attached to the instrument and may be any length. The sample is drawn into the device by means of a hand bulb aspirator. A platinum wire in the conduction tube within the apparatus is heated by electric current from dry cells enclosed in the case, and as the sample is drawn to this point, any combustible hydrocarbons contained in it will burn at the surface of the platinum filament. The additional heat furnished by this combustion will raise the temperature of the filament and thus increase its resistance, which in turn will cause the pointer to move over the indicator dial, marked to show directly the amount of hydrocarbon vapor in the sample. To insure that there is no chance of combustion being transmitted from this reaction

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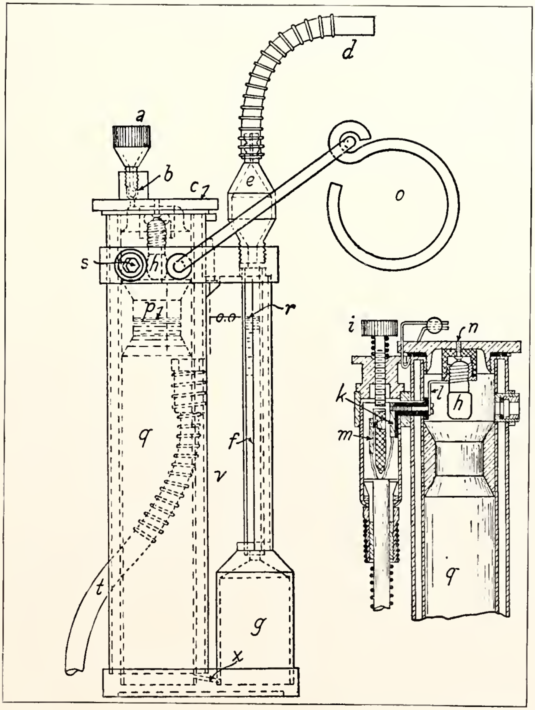


Courtesy—U. S. Bureau of Mines

The above is a detail drawing of the Burrell indicator

The Modern Trend in Car Design

By Herbert Kreisman, '34

Student in the Department of Mechanical Engineering

WHENEVER one reads fanciful articles of the world as it will appear a hundred or more years from now, whenever one sees pictures of the universe to be enjoyed by coming generations, the question of speed is always outstanding. Indeed, even today, every effort is being made to increase the possible rate of travel of all modes of transportation. Prizes are continually being offered for pioneers into the realm of speed; inventors are endeavoring to cut traveling time by means of rockets and similar devices. With all this in mind, automobile manufacturers are slowly but surely improving their models to accomodate public demands. Of high importance in this question the problem of streamlining arises.

The most serious impediment to the manufacture of streamlined cars is public opinion. If we started out today to design a fast automobile, and were not handicapped by precedent and fashion, our new automobile would not look, act, or be mechanically arranged like present vehicles.

When the automobile was originally designed, 30 or more years ago, it was a slow moving vehicle, the next step forward from the horse and wagon. Speed was conspicuous by its absence; in the beginning, the so called horseless carriage was simply a carriage without a horse. This style did not last long, for two reasons; first, the public was dissatisfied with the staid design and wanted to see evidence of increased power, and second, there simply was not room for increased power under the seat. Thus the engine was moved in front and the passenger compartment behind, a style which has remained to this day.

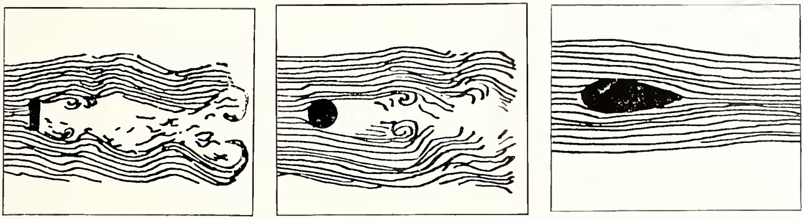
Now, when the automobile is no longer an uncertain, temperamental, slow speed, short distance car, one of the outstanding requirements and virtues is speed. With speed comes increased air resistance in more than direct proportion, and with increased air resistance, consideration of scientific streamlining becomes of prime importance in relation to speed, horsepower required, and fuel economy. With the problem of air resistance one wonders why the present style, with engine in front, and the wind-disturbing body, has persisted so long. Let us look into the relationship of wind resistance to car performance.

Wind resistance is the greatest factor that has limited car performance and economy. If the laymen who purchase and drive cars knew just what hard-beaten engines and present body designs do to the gasoline that they pour into the tanks, and how much change in design could affect the situation, it is probable that our present-day cars would be carrying streamlined bodies.

The [illegible] of fully streamlined tear-drop design shown recently in London.

If a flat body moves through the air in a direction perpendicular to its plane, or if the air moves toward it, disturbed airstreams and eddy currents are produced. The air is violently parted by the flat surface, and behind it a partial vacuum is created which tends to retard motion. If the flat surface is replaced by a cylinder, eddy currents and a following vacuum are still produced, but are very much less intense. A very similar action results from the use of V-shaped radiators.

If, however, a body having the shape of a raindrop is moved through the air, the air resistance is reduced to the minimum; the round leading end divides the airsteam smoothly, permitting the stream to converge without eddies and without a vacuum at the rear. Because of design difficulties this ideal shape cannot be duplicated



Courtesy—Society of Automotive Engineers

Air flow around bodies of various shapes.

in the automobile, but it can be very closely approached.

In order to determine the resistance due to wind, and consequently the remedy, numerous and interesting tests have been made both in this country and abroad. For use in these tests, complete, three dimensional models, one-quarter size, are cast in plaster-of-paris.

Virtually every present car, when moving along the ground, crowds the air under the chassis, increasing its velocity and decreasing the pressure along lines parallel to the direction of motion. This creates a cross-wind force which tends to draw the car toward the ground. On the other hand, it is possible that the particular shape of an automobile will cause the air under it to tend to lift it from the ground. Thus we see that ground effect must be taken into consideration when measuring air resistance of an automobile.

If the model to be tested were to be suspended, the ground effect would obviously be lacking, and the air resistance measured be incorrect. If the model were to be placed on a floor, and the wind sent against it, the computed measurements would be incorrect because of the friction of the air on the floor. In the case of a moving car, the road friction of the air has no bearing on the problem. The solution was offered in the supporting of an exact duplicate dummy, upside down, directly under the model, at which time the desired requirements are fulfilled.

Another experiment in the determination of air resistance is performed by the use of a mixture of lampblack and kerosene. This mixture is blown over a model, the resulting lines showing the directions of the air currents.

After having determined the effect of wind in relation to the style of the car, the next important question is how the car can be streamlined without affecting the esthetic values of the car. To obtain perfect streamline, or even a near approach, is practically impossible. The problem appears to be to reduce only unnecessary air resistance, inasmuch as the car must be sold to the public, to whom the appearance is as important as its mechanical merits.

Before considering some of the improvements that could be made on the body and other sheetmetal work, it should be remembered that the chassis also offers air resistance. As long as the cooling of the engine is done in the present way, a large area of air resistance will always exist regardless of the shape of the radiator core. The bottom of the chassis could be greatly improved by covering it with a set of sheet metal pans to decrease the road drag, the pans being made so as to afford easy access to all parts that are frequently inspected. All parts of the car can be made to offer less air resistance and this can be done without producing freakish effects, but it requires experimentation and good taste.

Complete streamlining of the rear end of the body is out of the question for the present, but the formation of eddies that the present shape of the sedan bodies causes, which is one of the major resistances to the speed of the car, can be reduced somewhat without radical and objectionable changes if the shape be corrected only below the belt line, leaving the upper back much as it is now so as not to interfere with the headroom and the rear window opening.

The plan design of the car is as important as the side contour. All designers know that the closer the widest part of the body is to the highest part of the roof, the better appearing proportion will be obtained. The widest part of the body could be moved forward without sacrificing any of the rear end space. This would reduce the width of the back, improving appearance and reducing air resistance.

The problem of ventilation in our automobile bodies needs attention, and we can enlist the aid of the aerodynamics expert in this. It is doubtful if this question has ever been given any serious thought by manufacturers.

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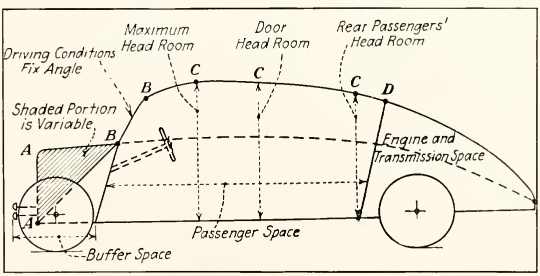


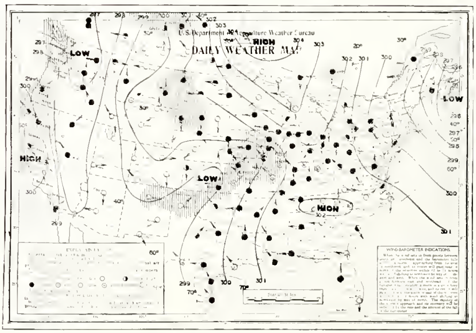
This drawing clearly illustrates the utilization of space in tear-drop models.

Essentials of Weather Prognostication

By John L. Kampwirth, '33

Student in the Department of Civil Engineering

THE weather affects everyone; nowhere is it possible to find a human being who is not concerned, directly or indirectly, by the kind of weather that is each day meted out to him. On it depends the comfort, convenience, safety and prosperity of mankind. Everyone's disposition responds to a bright, sunny day, or to a gloomy, disagreeable one. Because of its extreme importance to all, it is not strange that from earliest times signs and omens have been sought by which to foretell the weather.



A synoptic chart of weather conditions as issued daily by the U. S. Weather Bureau.

The earliest weather records of any nation are to be found in those myths, or popular tales, which describe rain, cloud, wind, and other natural phenomena in highly figurative language. The most interesting thing about these myths is the remarkable fidelity with which they reflect the climate of the country in which they originated. For example, from the mythologies of Greece and Scandanavia we can very nearly build up an account of the climate existing in these two countries by translating their figurative language into modern description.

The survival of much of this phraseology is reflected in popular prognostics and in cloud forms of modern times. In England and Sweden "Noah's Ark" is still seen in the sky, while in Germany the "Sea Ship" still turns its head to the wind before a rain. In Scotland the "Wind Dog" and the "Boars Head" are still the dread of fishermen, while "Goat's Hair" and "Mare's Tails" are names known to every sailor.

As nations progressed these premonitory signs of good and bad weather were developed into those short proverbs which make up popular prognostics. A great many of these are still current in many parts of the world but their reliability and quality are varied. Some are based on phases of the moon and other planetary movements, while still others are very valuable and, correlated with other aids to weather forecasting, present a system of prognostication which will always be in vogue, especially on the seas. Let the sailor, a backwoods farmer, or some hard-blown, leather-faced riverman take a "squint" at the weather and its signs, and he can give you a very accurate prediction of what the next few hours will bring in the way of weather. It is essential to his well-being, and to his safety, that he be able to do this.

The ability of mariners to forecast weather changes from local observations is proverbial. This is not because the signs are so much more pronounced over the sea than over land, but primarily because the mariner has no other source of information and must learn to interpret their significance. On land a heavy storm is not so often a matter of life and death, and consequently, while most people recognize a few signs, they very seldom follow them out systematically to determine their reliability; most of the weather forecasting practiced by mariners is the result of many years of observation. A sailor needs no book on meteorology to tell him the invariable sequence of events in a cyclone. He knows that a soft rain always precedes a cyclonic disturbance, and that when the wind precedes the rain the storm will be of short duration. Likewise, those who follow the sea take warning when sea birds hunt the safety of the land.

About three-fourths of the population of our country can be readily reached with the information circulated by the United States Weather Bureau by means of its publications, by the daily papers, by radio, telegraph, and telephone. The effect of this service has been to make us entirely dependent upon the weather man and his advice. Even the most reliable and pronounced signs often mean nothing to us because we have given up the idea of making our own observations and forecasts.

Despite the fact that truly weather-wise people are becoming few in number, weather obser-

(*Continued on page 119*)

The Solvay Process of Alkali Manufacture

By Stanley M. Lind, '32

Student in the Department of Chemical Engineering

THERE are today three important processes used to manufacture alkali, the Leblanc process, the Solvay process, and the electrolytic process, with the Solvay process being at present in advance of the other two. The Leblanc process was developed in France about 1790, so is very old and consequently has a firm foundation, but in spite of improvements effected during recent years, cannot compete economically with the Solvay process. There are two reasons for this, the most important being that the sodium in the latter costs next to nothing, being obtained from natural or artificial brine in which the sodium chloride possesses an extremely small value, while in the Leblanc process the sodium chloride must be relatively pure and is consequently more difficult to obtain. Also, the fuel required in the ammonia-soda process is less than half that used in the Leblanc method. The Solvay process has been elaborated into a very complicated but perfectly working scheme in which the cost of labor and the loss of ammonia have been reduced to a minimum. The only way in which Leblanc process could hold its own was by being turned in the direction of making caustic soda, to which it lends itself more easily than the ammonia-soda process. One advantage remained to the Leblanc process for a long time, but now that is eliminated. Early endeavors to obtain the chlorine of the sodium chloride used in the Solvay process in a form which would be useful were fruitless; calcium chloride was the final product, and was at that time considered as waste. The Leblanc process could furnish chlorine in any one of several active forms, and because of this fact, held the upper hand in Great Britain and other foreign countries. However, a myriad of uses for the calcium chloride waste was found, whereupon the Solvay process became economically a success.

A "Solvay Tower" for the production of sodium acid carbonate.

The electrolytic process is in theory the simplest method for making alkalis, but is as yet still in its infancy. No doubt in the future it will become an economic competitor for the Solvay process.

Probably the first real step in the ammonia-soda process occurred in 1838, when H. J. Dyar and J. Heming, two Englishmen, patented a process which they had carried out experimentally in Whitechapel, England. Many attempts were soon after made in the same direction, both in England and on the continent, the most remarkable of which was the ingeneous combination devised by J. J. T. Schlossing and E. Rolland. But a really economic solution of the problem came in 1872, by virtue of the work of Ernest Solvay, a Belgian.

The Solvay process as carried on commercially today differs very little from the original conception. The basic reaction of the process is the mutual decomposition of ammonium acid carbonate and sodium chloride:

$$NH_4HCO_3 + NaCl = NaHCO_3 + NH_4Cl.$$

It begins, however, not with ready-made ammonium acid carbonate, but with the substances from which it is formed, ammonia, water, and carbon dioxide—which are made to act on sodium-chloride. In practice the process is carried out as follows: A nearly saturated solution of sodium chloride is prepared by purifying natural or artificial brine, removing especially the alkaline earths by the addition of sodium or ammonium carbonate and settling out the precipitate thus formed. This solution is then saturated with ammonia in vessels provided with mechanical agitators and strongly cooled by coils of pipe through which cold water is flowing. These vessels, as well as all others used in the process are not open to the air, but communicate with it through washes in which fresh salt solution is employed for retaining any escaping vapors of ammonia.

The ammoniacal salt solution is now saturated with carbon dioxide. This is employed in the shape of lime-kiln gases, obtained in a relatively pure and strong form, (up to 33% CO_2) in very large kilns, charged with limestone and

(*Continued on page* 122)

ENGINEERING NEWS

An Automatic Pilot

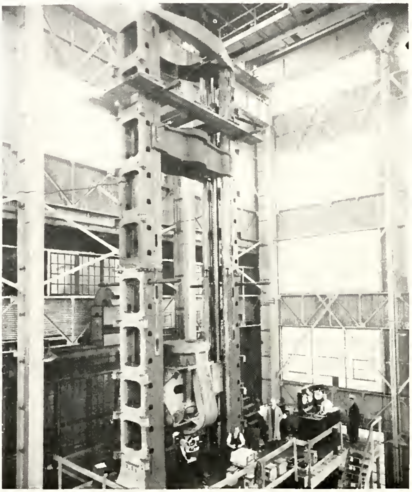
An automatic pilot based on the use of the gyroscope has been placed after long development work in actual commercial use on the planes of one of the larger transport companies. The device maintains the plane on a level keel and on a straight course without intervention by the pilot. Not only does it relieve the pilot on long flights, but it assures level flying in foggy weather, and gives the passengers infinitely more safety and comfort. Even when turning it is possible to prevent banking of the plane.

Two gyroscopes are employed, driven by a propeller in the air stream. Another similar source supplies power to the controlling mechanism, in which the shafting and gearing are in constant motion. One of the gyros spins about a horizontal axis; the other is for lateral and longitudinal control, and it spins about a vertical axis. Both gyros, mounted on gimbals, are free to swing about three axes in space.

When the aeroplane departs from of a straight course, rolls or pitches, the gyros in the automatic pilot are displaced relative to the plane. By this change in relative positions, electrical contacts are established which bring clutches into operation. The clutches engage parts of the control mechanism with the constantly running power shafting; the control mechanism operates the rudder, elevator, or ailerons as the case may be. A follow-up system then comes into play by means of which the electrical contacts are withdrawn, preventing over-control.

World's Largest Testing Machine

The University of California has just been the recipiant of a testing machine which in point of dimensions is by far the world's largest. It is able to test columns



Courtesy—Scientific American
The gigantic testing machine recently received by the University of California.

up to 33 feet long in compression and up to 4,000,000 pounds load. In tension it accepts specimens up to the same length and will apply loads up to 3,000,000 pounds. The spread between the columns is ten feet and the table is 12 feet long. Since the table is level with the laboratory floor a truck may drive between the columns and the specimen be lifted directly from the truck body by the testing machine itself.

There are many unusual features in this testing machine in addition to its great size and unprecented capacity. Since the principle load application is hydraulic it is necessary to provide a cylinder and ram and a pressure-producing fluid pump. The ram on this testing machine is 46 inches in diameter and the hydraulic pressure is about 2500 pounds per sure is about 2500 pounds per square inch when operating.

New Source of Rayon Found

Using low-priced nitric acid, the U. S. Department of Agriculture has developed a process for making cellulose from bagasse, the waste from sugar cane after the sugar has been extracted.

From 250,000 to 500,000 tons of bagasse accumulate each year at the sugar-cane mills of the United States. Large quantities are used as fuel by the sugar mills, and for several years great amounts have been used for manufacturing insulating materials.

The possibility that a higher grade of cellulose could be produced from bagasse led the chemists to experiment with it. The process increases the potential value of bagasse and at the same time offers a new and steady source of raw material for the rayon industry.

The method, known as the nitric acid pulping process, consists of soaking the raw material in a weak nitric acid solution for several hours at a medium temperature, heating it for an hour and finally washing and boiling in dilute sodium hydroxide to produce a soft, bleachable pulp. Cheaper supplies of nitric acid make the process commercially feasible. Some of its advantages as compared with older methods of processing bagasse are that open tanks are used instead of pressure tanks, and less heat, power, and time is required.

The Ultra Centrifuge

Man's search for the ultra in speed of rotation of pieces of apparatus has, it is believed, been attained in a new high speed centrifuge, capable of a speed of 500,000 revolutions per minute; this apparatus will enable the separation of liquids which have to now existed in collodial suspension.

The rotating part or rotor is about one inch in diameter. The remainder of the apparatus is called the stator. Air from a compressor is admitted to the chamber through a valve in the base of the chamber. The rotor is then placed in position. Tiny air jets immediately under the rotor impinge on and slightly raise it. As its under-surface bears diagonal flutings, the rotor is given a rotatory motion. It finds a position of stable equilibrium very near the stator and continues to rotate at high velocity entirely on 'bearings' of air. With a steel rotor one inch in diameter and air at 100 pounds pressure per square inch, a velocity of 3500 revolutions per second was easily obtained. The velocity remains constant as long as the air pressure remains constant.

Means of introducing liquids into the centrifuge while revolving at high speed have been perfected as have means of removing them. This is possible because the rotor is hollow and because of the presence of small communicating openings near the top center.

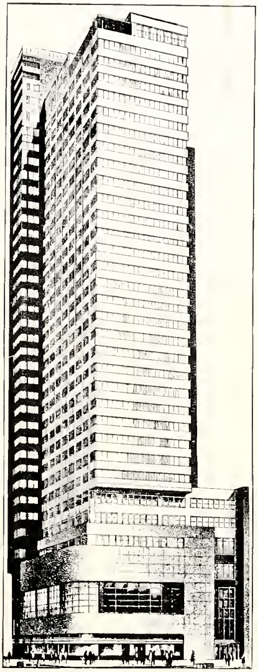
Alcohol From Wood—Not Wood Alcohol

Real alcohol can be made from wood by an improved method recently discovered in England. This method is commercially practical where sawdust can be obtained for a dollar a ton and a supply of 200 tons a day is available. The process is capable of extracting 35 to 40 gallons of alcohol from each ton of dry sawdust.

The process consists in forcing acidulated water, containing two parts of sulfuric acid per thousand, at a temperature of 180 degrees Centigrade and a pressure of 12 atmospheres, through sawdust packed in leadlined vessels. Under these conditions nearly half of the sawdust is changed into fermentable sugars. The molasses thus obtained is fermented with yeast in the usual way to obtain the alcohol.

A Unique Design

Great architectural dissention has developed in Philadelphia, Pa., over the design of a new



This building presents a frontage which is 65% glass.

bank and office building in the center of that city's shopping district. Its architects, Howe and Lescaze, claim that it has definite functional beauty, since it more clearly expresses its interior use than do the more staid buildings in its neighborhood.

Structurally, the unique feature of the building is its unusual area of window space, deliberately planned to admit all possible useful daylight. This is obtained by stepping out from the structural columns a series of "balconies" and connecting them by uninterrupted windows, innocent of even corner supports. In this way the front wall is 65% glass.

Vertical communication between floors, including elevators, pipe shafts, and air ducts, is all centered in the rear of the building. Therefore that section has been clothed in glazed black face-brick to serve as a back bone for the lighter office floors which branch from it like so many ribs.

Fish Elevators at Baker River Dam

Salmon climb ladders and ride in elevators to the top of the 253 foot Baker River dam in Washington. In traveling downstream a salmon merely allows the current to carry him along, but in going upstream when returning to the spawning grounds, he often finds barriers that he must take.

Taking advantage of the topography near the dam the first step in the progress of the salmon to dizzying heights is a 100 foot fish ladder. Next comes about 700 feet of flume ending in a final 2 foot overpour at the foot of an inclined track. The pool above this last rise consists of a steel box on wheels, hoisted up the incline when it has become full of fish. At the top of the incline, the car delivers into a hopper and the fish slide down a wooden chute into the lake back of the dam.

Sound Bullets for Fog Navigation

In recent tests off the New England coast, bullets of sound which bound back to the boat from which they are sent and warn the pilot of fog-screened obstacles in his path have been employed in an acoustic navigating device. The new device is termed a sonic locator and is a direct outgrowth of the sonic altmeter recently developed. In the same manner as the latter, by the use of the sound echo principle, it warns the navigator of boats, buoys, or shoreline which may be totally obscured by fog.

A sending megaphone mounted on the boat projects short blasts of a high frequency air whistle. These blasts strike objects ahead and rebound as echos. The number of seconds elapsing during this interval determines the distance of the objects from the boat, in plenty of time for the pilot to avoid hitting them. Besides the sending megaphone, the new device consists of a pair of binaural receiving megaphones mounted in a framework which may be turned with a handwheel inside the cabin or listening post.

The Armour Engineer

Published Quarterly by the College of Engineering
ARMOUR INSTITUTE OF TECHNOLOGY

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Make The Armour Engineer the best technical college publication in the country.

Ideals are like stars; you will not succeed in touching them with your hands, but like the seafaring man on the desert of waters, you choose them as your guides, and following them, you reach your destiny.

—Carl Schurz.

THE DEVELOPMENT PLAN of Armour Institute of Technology has as one of its major points the elevation of entrance requirements and a more exact selection of students. The former will occur progressively so as to work no hardship upon students in the transition period; indeed, the class of 1936 will be chosen under elevated scholastic standards prior to their admittance next fall.

The new features in student selection will attempt to solve the grave problem of determining the individual's fitness to pursue an engineering education. It is well recognized that the average secondary school graduate is an insufficient judge of his own fitness for technical training. Further opportunity for self-discovery and a broader outlook is necessary before an educational program of definite vocational aims can be attempted with confidence. The early years in college are all too apt to remain a sorting ground for our preparatory graduates; this is a frank confession of the great need for a scheme of selection which will place in the technical college those students who may be classed as "good risks" for an engineering education.

The enormous practical value of some reasonable plan of selective admission to the student, to the college, and to the industry that employs the technical graduate is so apparent that a consideration of this problem is entirely worthy of much time and attention.

In all probability the already old idea at Armour of the personal interview will be elaborated upon tremendously and will form the nucleus for an intensive program of study of each candidate student to determine his fitness for technical education, and more important, to assist him into that walk of life which will gain him maximum satisfaction and advancement.

WITH THIS ISSUE THE control of the Armour Engineer passes from the hands of the seniors to those of the juniors. It has been the custom for the May issue to be published with the newly elected editors acting in the executive positions. The seniors merely act in a supervisory capacity.

The Managing Board believes it has made a wise selection of men to fill the offices of Editor, Associate Editor, and Business Manager. The present members of the Board sincerely believe that the new executives will prove their merit and will warrant the responsibilities placed with them. With the present plans for future changes and expansion of the Engineer within the next school year, the new men must be possessed of those qualities of experience, ability, and aggressiveness so necessary to their positions. This issue stands as the first result of their endeavors.

IN THIS MODERN DAY COLlege athletics has, to a large extent, lost its fundamental incentive. The true desire of every academic department of physical education should be to promote and foster the means by which students may build up strong bodies at the same time they are developing their minds.

All sports, as baseball, track, swimming and tennis, have definite value if participated in sensibly. However, it is in this last that the trouble arises. It is the desire and hope of every college student to obtain a good education accompanied by a sound body, yet, the majority of these students, if they feel they cannot win a letter, will not participate in a sport. Consequently, their bodies do not receive proper exercise.

At Armour the average scholar works rather strenuously at his studies, usually keeping late hours. Obviously he cannot maintain the physical condition required by a competitive sport. However, he need not try for an award, but may participate mildly in order that his health may be maintained.

The primary incentive, it must be remembered, is not to make the varsity, but, rather, to become strong through exercise. It follows that the former will be a natural consequence of the latter.

THE WEEK-END OF THE ENgineering student, and of any man, is equally as important in his education as the long hours spent in the classroom and the weary nights used in preparing the following day's work. To many the few hours at the end of the week mean that much more time to write reports, solve difficult problems, and read a required amount. Education has a much broader sense than the total of book learning digested; it may be defined as the ratio of the amount of knowledge assimilated to the amount of knowledge to which the individual is exposed. The person failing to take advantage of the opportunity to secure a well-rounded development through social associations will seldom be termed educated.

It is for this reason that the week-end plays such an important part in the life of the student engineer. In this time he may secure that valuable education, necessarily lacking, to a marked extent, in a technical college. Rather than use the few hours at the end of the week in outside preparation only, he would secure much more valuable knowledge in talking with people, learning their views, conversing in their style, seeing arguments from their point of view, and, in general, obtaining a simple psychology, easy in its method of teaching, inexpensive in cost, and of exceedingly great benefit in present and future use.

AT THE PRESENT TIME, the word "success" is rarely used. In the mind of the average individual persons who may be termed a "success" are exceedingly few. This word has received much abuse, for there are many people who would come under its scope if the true meaning were known.

Success is strictly a personal matter; it may, perhaps, vary with the individual, depending upon the person judging him, but you are the one, and the only one, to determine whether you are a success. Success depends upon the happiness of the existence of the individual; if a men leads a happy life he is a success. No matter how poor in terms of wealth, no matter how educated or illiterate, no matter what his physical or mental capacity may be, this man is a success, because he is happy, the ultimate goal of existence. True, in the eyes of his fellowmen, he may belong to the lowest class, he may be entirely shunned, but their judging does not matter; he is happy, he enjoys living, he derives pleasure in performing his simple tasks, he has achieved Utopia, he is a success.

The relationship of money and success must certainly be mentioned; they are vitally connected. Monetary remuneration often is the basis of success. It is undoubtedly a stepping stone in the achievement of success, but merely and only because it increases the chances of happiness.

We have observed that success is strictly a personal matter; the poorest person can be equally as successful as the richest. It is left entirely to each man to fashion his own life, to set his own goal. The men of '32 leave us very soon to seek their places in life; we sincerely hope the true spirit and the real good of existence will shape their careers.

IT IS EXTREMELY DIFFIcult to evaluate the effects of harsh and excessive noises on the human body. Nervous fatigue is induced, and the individual whose life is saturated with city noises, from traffic, railways, radios, factories and hucksters, tends toward greatly lessened efficiency, an increased irritability, and even neurosis. It has been stated that "within a generation, noise will vie with disease unless the same mechanical ingenuity that has called the mechanical robot of the age into existence shall also be able to endow it with a soul of quiet."

Research has shown that sudden noise increases the rate of heart and respiration, and the blood-pressure of man and animal. The mental effort of the more highly developed individuals is hindered by noise. Sudden harsh sounds cause fear reactions, apparent in muscular tension.

The problem has been carefully studied for many years, especially in England. In 1917 a National Fatigue Elimination day was initiated as one means of directing public attention to preventable noises. In the United States, some cities have experimented with noiseless street-cars, and patented noise preventing rails are in use in others.

Certain legal restrictions on noise may be properly imposed, but the prevention of excessive noise is very largely an engineering problem.

THE PROBLEM OF ESTABlishing a high professional standing of engineers is one which is now being investigated by engineering groups throughout the country. Today there exists the same need for the universal registration of engineers that existed some time ago with regard to the medical and legal professions. It is expedient that we have uniform and exacting requirements to be fulfilled before a man may take upon himself the responsibility of others' lives and interests. This has hitherto been done in other professions by means of state boards. Inevitably, the engineer will be the subject of legislation, either as an individual or as a member of a group, and it is essential that he be in control of the situation.

College Notes

A. S. M. E.

Members of the A. S. M. E. were invited by the W. S. E. group, March 1, to hear Mr. Eugene S. Taylor give a talk on the Chicago Plan Commission. Mr. Taylor, who is manager of this group, gave a description of it, its history, duties, and present activities. The work of the Commission is to make and develop specific plans for the betterment of Chicago.

On April 8, two practical speeches were presented. One was given by Professor P. C. Huntley, who discussed patent law and some of its phases. The other talk was presented by Mr. R. R. Leonard, who pointed out the importance of the student branches of the A. S. M. E. and urged further participations by the members.

Mr. James McThoy of the Studebaker Corporation presented a very interesting talk Friday, April 22. His subject was "Experiences in Russia." Mr. McThoy, who has spent two years in Russia, related some very interesting incidents illustrating the conditions under which technical men have to accomplish their work.

A. C. S.

Friday, April 22, at the regular monthly meeting of the American Chemical Society, Joel H. Hildebrand delivered an address on "The Intermolecular Forces in Liquids, with Relation to Solubility". This meeting was held at the Midland Club.

Mr. Hildebrand is a chemistry professor at the University of California, and is recognized as one of the foremost workers in the field of chemical solubility. He has also done some research work on the stability of chemical compounds, emulsions, and electroanalysis.

Armour students in chemistry are always present in great numbers at the regular discussion meetings of the society. It affords them a definite opportunity to gain the professional viewpoint, very important as distinguished from the academic stand.

W. S. E.

The annual smoker of the Armour branch of the Western Society of Engineers was held Wednesday, April 27, at the Phi Pi Phi Fraternity House. A number of non-members were present, as well as a galaxy of the organization's mainstays. The pledges of Chi Epsilon presented a very interesting and unusual program which was enjoyed by everyone present.

On Friday, April 29, R. F. Stellar delivered an address on "Some Aspects of the Illinois Waterway". Mathew F. Beisbier, traffic engineer of the Chicago Motor Club, addressed the society at a later date, on the subject of "Traffic Engineering". This is a field which is growing in importance with the development of faster and higher powered motor vehicles. It was conceived only about 15 years ago, when the automobile began definitely to monopolize the roads. Mr. Beisbier received the degree of Mechanical Engineer from Armour in 1928.

OUR VARSITY CAPTAINS

Golf

David W. Pearson

The Tech golf squad is very capably led in its present season by "Dave" Pearson, a junior in the department of

David W. Pearson

fire protection engineering. His ever consistent play in competition has done a very great deal toward elevating the team to its present capability.

Dave boasts of Portland, Oregon, as his birthplace, the momentous event having occurred on Oct. 6, 1910. His secondary education was received at Washington High School, of Portland. Here Pearson played on the golf team for three years, being captain in the last two. He also served as a member of the basketball team, the group being Oregon State champions in his junior year and Portland city champions in his last two years.

Dave served as a "regular" on the Armour golf squad during his freshman and sophomore years, and had his steady brilliance and work rewarded with the team captaincy in this, his junior year. His scores have remained constant throughout, and he can always be relied upon to turn in a card of 80, never much higher.

The golf captain has had his ability recognized by a membership to Honor "A", and has aided his class through 3 years of interclass basketball competition. Pearson owes allegiance to Delta Tau Delta Fraternity.

A. I. Ch. E.

The long awaited A. I. Ch. E. smoker was held at the Theta Xi house, March 24. With a wide assortment of games, amongst them poker with stage mazuma, bridge, euchre, and roulette, the evening progressed rapidly. Hidden talent was brought forth when various members gave their versions of popular and classical tunes. The high point of the evening was the serving of refreshments.

In this same day, a meeting of the society was held. Four student talks were presented to the members, the common subject of these talks being "Plastics." These men had been doing research in the literature on the condensation products of urea, formaldehyde, and thiurea.

April 19, Dr. Muscat, director of chemistry and chemical engineering for the Century of Progress, presented a talk to the students on the Century of Progress.

A. I. E. E.

On March 4, the members of the A. I. E. E. were again given the privilege of listening to Mr. Herman Halpenin of the Commonwealth Edison Company. His subject was "Underground Cables" and dealt with the construction, care, and operation of various types of cables.

At another meeting on Friday, March 13, Mr. L. O. Sinderson, engineer of the local General Electric Company office, presented "Automatic Elevators and their Control" to the students. Mr. Sinderson pointed out that there are two kinds of elevators, the geared, and the gearless. These two types were compared and discussed.

On April 1st, Mr. Petersen of the Commonwealth Edison Company gave an illustrated talk on generating stations in Chicago. All three of the stations were discussed. It was pointed out that one-third of the Chicago River is pumped through the Fiske Street station for use in condenser cooling.

Thursday evening, April 21, a live group of Armour students journeyed down to the Medinah Athletic Club to attend the annual smoker of the Chicago Section of the A. I. E. E.

F. P. E. S.

The Fire Protection Engineering Society held a very interesting meeting on April 22. Mr. D. Wood, of the Chicago agency of Childs and Wood, spoke on "The Local Agent's Place in the Insurance Business." His discourse was very encouraging as to possibilities in the field, and was intended to urge the men to widen their scope beyond technical engineering as soon as practicable.

The annual smoker of the society will be held in a few days; as always, a great time will be had. The "fire protects" are known as well able to enjoy themselves whenever the time and place presents itself.

Tech Netmen Enter Into a Noteworthy Season

Coach Colvert's squad of racqueteers has a very good season in store for itself. The large number of men who have turned out for places on the team gives promise of a successful season. Streb, the only letter-man back from last year, will probably be listed first. However, with the aid of Paine, Lind, Cone, and Armsbary, a long list of victories may be garnered.

Manager Schodde has worked very diligently to bring about enough competition for the netmen. He has succeeded remarkably well. Matches with Notre Dame, Coe, Ripon, Lake Forest, Wheaton and Loyola have been obtained. Keen competition is expected from the majority of the teams. The Tech squad has engaged in a number of practice matches with the University of Chicago varsity team.

Loyola defeated Armour at the Loyola courts, 4 to 3, on April 29. This aroused our squad to a high pitch of activity, and when these same opponents came to Tech for a return match on May 2, the Armour squad won, the score again being 4 to 3. The Wheaton squad came to our courts May 16, to engage our men in their third meet of the season. The men who are playing regularly for Armour are Streb, Paine, Cone, McDonough and Armsbary. The remaining schedule is listed:

May 21, Coe at Coe, Cedar Rapids, Ia.
May 24, Lake Forest at Armour.
May 28, Ripon at Ripon, Ripon, Wis.
May 30, Wheaton at Wheaton.
June 1, Ripon at Armour.

The Rifle Club

The Rifle Club at Armour has been a very successful organization. Its team, consisting of S. Patla, C. Sachs, A. Helmick, D. Wilson, W. Hollman, J. Mauer, K. Hackley, has won the State Championship for the fifty foot range in the prone position. The men from Armour also took the first three places in individual scoring, Helmick being first, Patla second, and Hollman third. This match was conducted by the National and Illinois State Rifle associations.

At a recent meeting of the club, E. Wandrey was elected president, D. Wilson, vice-president, and K. Hackley, secretary-treasurer.

The members are now training their eyes for a match that will be held in the near future with the Humboldt Park Gun Club. This will be the first of a series of matches consisting of two indoor meets at 75 feet, and one outdoor meet at 50 and 100 yards. The trophy that is the award to the winner of these matches is a silver cup which is now in the possession of Armour. The boys will be trying hard to retain this valuable cup.

Baseball Nine Seeks Conference Trophy

Aspiring to add another trophy to Armour's collection, Coach Krafft and his squad of twenty-five ball chasers have rounded into great shape in order to keep up the good work of winning more ball games. The squad started the season successfully by defeating a strong Chicago Normal nine and tieing Crane College at Ogden Field. Then came an off day; the team was defeated at Naperville by a formidable North Central nine. Producing a barrage of hits in the first inning and keeping the Elmhurst sluggers at bay, Armour turned in a well-earned victory by a score of 10 to 8. Improving steadily, the Armour aggregation successfully turned back the attacks of the Wheaton nine to the tune of 6 to 2. The adeptness with which the team handled the ball was the outstanding feature of this game. Gaining in experience, the men are learning fast the necessity of teamwork.

Baseball Squad, 1932

Back row, left to right: Coach Krafft, V. Omiecinski, Levy, Lillis, Baumel, O'Connor, Stehno. Center row: Cosme, Machinis, Sommer, Galvani, Buehne, Lukas. Front row: Biegler, Young, T. Omiecinski, Reed, Evans, Morrelli, Mayer.

Lack of obtaining hits in crucial moments of the North Central-Armour return game made Tech take the short end of the deal at the finish of the game. Making a most excellent showing against the much reputed Michigan Normal team, the squad kept the teachers to a standstill up to the latter part of the game. With a man on third, Michigan attempted a "squeeze play" which proved very effective since no other run crossed the home base for either team. A moral victory could be given to Armour because the latter had garnered five hits to their opponents three.

The ability and spirit displayed in this contest certainly portrayed the fact that Armour may still be counted in the running for the Northern Intercollegiate Conference flag. Each foe is engaged twice and thus the chances are remote of any team leading and winning by virtue of a very few close victories. The school interest is intense, and whatever the final standings, the student body well realizes the work involved in play on the nine.

Cindermen Gain Victories and Fame

Armour's tracksters gained considerable experience and numerous medals in the recent Armour Relays. Competing in these various events has given the trackmen "confidence superb" in their ability as runners. The relay team, consisting of Hirsch, Kreuzkamp, Jens and Sademan, took third place in the 880 yard relay. A similar score was chalked up for Armour when Lind, Hirsch, Roberts and Sademan took third place in the two mile relay. Jens and Frateschi added three points by virtue of a third and fourth place, respectively, in the shot put.

A successful season of indoor competition has been completed. The first victory was a triumph over La Grange. Taking nine firsts and nine places for a total of 57½ points the tracksters won a triangular meet in which La Grange, the University of Chicago "B" team, and Armour participated. Then came victory number three over the Sears "Y." An out-of-town meet at North Central proved disastrous; the team lost by a close margin. Refusing to be discouraged, the squad came back to defeat Crane Junior College by a 54 to 50 score.

To commence the crucial outdoor period, our team defeated "Y" College at Ogden Field, 80 to 51 points. A double meet at Stagg Field, with Tech competing simultaneously, but separately, with Lake Forest and Milwaukee State Teacher's College, was split. The Lake Forest cindermen were defeated, 69 to 57, but the teachers overwhelmed our team to triumph, 88 to 37 points. The Milwaukee squad returned here the next Saturday to again defeat our boys. Bradley Tech was met at Peoria to officially end the season.

Golf Team Displays Potential Power

Armour golfers went into action quite early this spring to get into trim for some of the stiffest competition to be encountered in many seasons. After practising diligently at Evergreen, the team started with a bang with a victory over the Alumni by a margin of 13½ to 4½ points. Led by Capt. D. Pearson, Weldon, Johannison and Davidson turned in creditable scores to collect a neat point total.

After losing a close contest to Valparaiso, the Tech pill-chasers turned upon Crane's links-men and defeated the latter by a large score. The improvement displayed by the team in this last match gives rise to the belief that the Tech men will do considerable damage to their cards to obtain a lower score.

The schedule:
May 13—Toledo U. at Evergreen.
May 18—Valparaiso at Evergreen.
May 20—Crane at Crane.
May 28—Toledo U. at Toledo.

Tau Beta Pi

Illinois Beta of Tau Beta Pi held its spring elections early in April and initiated the new members on the afternoon of April 27. The new initiates are:

C. N. Clanton, F.P.E., '33.
W. W. Davies, Arch., '33.
J. W. Juvinall, E.E., '33.
J. L. Kampwirth, C.E., '33.
J. Moravec, Jr., M. E., '33.

The new men were guests of honor at an informal dinner held that evening at the Blackhawk Restaurant, at which time chapter officers to serve during the next academic year were elected. These are: Wilfred W. Davies, President; Jarl T. Sorensen, Vice-President; Carl N. Clanton, Corr.-Secy.; John L. Kampwirth, Rec.-Secy.; Prof. J. C. Peebles, Treas.; James W. Juvinall, Cataloguer.

Eta Kappa Nu

The honorary electrical engineering fraternity, Eta Kappa Nu, pledged at a smoker held in the Eta Kappa Nu rooms, late in March, the following men, all juniors of high scholastic standing:

W. Lange
D. Wilson
W. Dumser

Chi Epsilon

Chi Epsilon, honorary civil engineering fraternity, now has three men wearing its purple and white pledge ribbon. These men were pledged at a smoker held on April 4, at the Sigma Kappa Delta house. They are:

G. Beemsterboer
B. Loesche
R. Rooney

The Chi Epsilon rooms are usually quite busy with bridge and chess players. Professor Enz is the champion chess player.

Plans are being made for the redecoration of the fraternity rooms.

Pi Nu Epsilon

At a meeting held in the Tau Beta Pi rooms on March 15, four men were pledged to Pi Nu Epsilon, honorary musical fraternity. These men, now wearing the scarlet and grey ribbon, are:

R. Meehan
C. Clanton
A. Steinhaus
H. Meyer

Plans are being made for a smoker to be held in the near future.

Alpha Chi Sigma

Alpha Chi Sigma, professional chemical engineering fraternity, desires to announce the initiation of the following members; F. Cerman, '34; A. [illegible], '34; R. McFarland, '34; and

Armour Board of Publications Is Formed

The formation of a Publication Board which will have full control of the Armour Tech News and the Armour Engineer, has been announced by the Development Committee recently. The board is to consist of six student members, elected annually by the entire group, the head of the publicity department at Armour, and six faculty members. Faculty members serve for an indefinite period, and outgoing student members have a vote in the election of new student members.

The Board will be divided into two parts, one to publish the Armour Tech News, and the other to publish the Armour Engineer. However, the entire body will determine all matters of publication. It is believed that by thus coordinating the publications, their further growth will be brought about until they are in a position to render the Institute valuable service in furthering its development, and as representative publications.

The Board is entirely separate from all other administrative departments of the Institute. It is financially independent, and not open to supervision, censorship, or administrative intervention.

Faculty members on the Board are J. B. Finnegan, C. E. Paul, J. C. Peebles, W. H. Hendricks, W. W. Colvert, and E. C. Grafton. Professor J. J. Schommer is a member ex-officio. The student members consist of O. T. Barnett, J. W. Juvinall, R. E. Nelson, M. R. Beal, J. T. Sorensen and A. Viel.

Officers have been elected to serve during this and the next academic year. These are:

Prof. W. Hendricks.....Chairman
..James W. Juvinall..Vice-Chairman
Jarl T. Sorensen........Secretary
..Prof. W. W. Colvert....Treasurer

A constitution has been developed and all matters of organization completed.

Interhonorary Dance

The annual Interhonorary Dance, sponsored by the Honorary Fraternity Council, was presented in the Italian Room of the Allerton House on the evening of April 29th.

This picturesque room atop the twenty-three story club furnished an ideal site for the dance. The South Shore Seven rendered the harmony to make everything perfect.

A large number of alumni of the various groups were present and can testify to the success of the efforts of Chairman Cavanagh and his committee.

W. Hollman, '33. These men were initiated Friday, May 13, and despite the dire significance of the day are destined to join the leaders in the affairs of the student branch. On Saturday, May 14, a banquet was held at the College Inn, at which time due honor was paid the new initiates. Following this banquet most of those present attended the presentation of "The Blue Mask." This was enjoyed by both the students and their faculty mentors.

Sphinx

Sphinx, the honorary literary fraternity, each spring elects to membership the outstanding journalists and department heads of the various publications. Election is based on ability, work, and demonstrated leadership in the field of journalism. The new men are: H. F. Becker, Jr., S. B. Cone, J. W. Juvinall, H. Kreisman, J. H. Miller, R. E. Nelson, F. W. Paine, R. F. Rychlik, C. K. Simons, W. W. Lange, and J. T. Sorensen.

Sphinx very successfully conducted an all-publications smoker early in April for all staff members and workers on the Armour Engineer, Cycle and Armour Tech News. Warren Brown, sports editor of the Herald-Examiner, was the principal speaker. It is planned to hold this smoker annually under the auspices of Sphinx.

A Sphinx dinner is to be held on the evening of May 18th, at the Delta Tau Delta house.

Salamander

The honorary fire protection engineering fraternity, Salamander, rewards high scholastic standing by election to membership in the junior or senior years. At a smoker held on the evening of April 28th, at the Theta Xi house, two juniors were initiated into the fraternity. These were Bradford Larson and Jarl T. Sorensen. Professors J. B. Finnegan, O. L. Robinson and C. P. Holmes, and Mr. J. V. Parker, Mgr., Western Actuarial Bureau, as well as a number of the alumni, were present at the ceremony.

Pi Tau Sigma

At a smoker held at the Sigma Kappa Delta house on March 22nd, Pi Tau Sigma, honorary mechanical engineering fraternity, pledged the following men:

N. Penfold
J. Moravec
H. Monger
R. Dufour
P. Carlstone

Several alumni, and Professors Roesch, Peebles, and Huntley were present at the smoker.

Winners of the essay contest will be announced very soon.

Phi Lambda Upsilon

Phi Lambda Upsilon, honorary chemical engineering fraternity, held a smoker at the Triangle house on March 21, at which J. H. Miller was pledged. He is a junior in the Ch. E. department.

The active chapter is making plans for a convention to be held in the fall, at Denver, Colo.

The Armour Alumnus

Volume VII May, 1932 Number 4

New Trustees Are Announced

Colonel Frank Knox

William S. Monroe

Paul H. Davis

IN keeping with the enlargement of the Board of Trustees which is a part of the Development plan, six new members have been added to the Board during the last month. The new trustees are Colonel Frank Knox, William S. Monroe, Paul H. Davis, Russell Wiles, Stuyvesant Peabody, and C. Paul Parker. All of these men are keenly interested in engineering and industrial activity in Chicago, and the Development Committee feels that each of them will make a great contribution to the ultimate success of the whole Development Plan.

Colonel Frank Knox, publisher of the Chicago Daily News, has only been in Chicago for a few months, but it has been sufficient to make him one of the city's foremost citizens, one whose influence is felt in every branch of civic activity. Col. Knox began his newspaper career as a reporter and later city editor of the Grand Rapids Herald of Grand Rapids, Michigan, where he lived until 1900. The next twelve years he spent as publisher of the Sault Ste. Marie News, and after that he went east to publish the Manchester Leader of Manchester, New Hampshire.

Colonel Knox was general manager of the Hearst newspapers in New England for the next fifteen years. In 1920, he was Chairman of the New Hampshire delegation to the Republican National Convention. From 1927 to 1931, Col. Knox published the Boston American, and the Daily and Sunday Advertiser, another Boston paper. In 1931 he came to Chicago as publisher of the Daily News, following the death of Walter Strong.

Col. Knox saw his first military service as a volunteer in the 1st regiment of Rough Riders during the Spanish-American War. He served a year overseas during the World War, in the 78th Division of the 153rd Artillery. He entered the division as a Captain, and was promoted to Major during his service.

William S. Monroe, President of Sargent and Lundy, Inc., was the first new Trustee to be added to the Board under the Development Plan. Mr. Monroe took his M. E. degree at Cornell University in 1890, and has been with Sargent and Lundy since 1900. He became a member of the firm in 1911, and was made president in 1919. Sargent and Lundy are consulting engineers for the Commonwealth Edison Co., the Public Service Company of Northern Illinois, Middle West Utilities Co., Midland Utilities Co., Columbia Gas and Electric Co., and many other public utilities companies in the middle west.

C. Paul Parker

Mr. Monroe is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, and the Western Society of Engineers. He is a former president of the Western Society.

Paul H. Davis, another of the new Trustees, is senior partner of the Chicago investment firm of Paul H. Davis and Co., and is President of the Chicago Stock Exchange. His position as a director of several large industrial corporations makes him an exceptionally good man to serve on the Board of Trustees. Among the companies of which Mr. Davis is a director are the Evans Products Co., the Bendix Aviation Corporation, the Borg-Warner Corporation, the Pines Winterfront Corporation, and the Houdaille Hershey Corporation.

Mr. Davis is a graduate of the University of Chicago, and is active in the alumni affairs of the University. He is a member of the American Association of Mining Engineers. During the World War, he did Red Cross and Liberty Loan work here in Chicago.

Russell Wiles, a Chicago patent attorney, took his S.B. at the University of Chicago in 1901; his LL.B. and his

[illegible] western University in [illegible] a member of the patent [illegible] of Bitner, Wiles, and [illegible] in 1904, and in 1906 he joined [illegible] which is now Dyrenforth, Lee, [illegible] and Wiles. He is a member of the American Bar Association, the American Patent Law Association, and the Chicago Patent Law Association, of which he has been president.

Mr. Wiles has been associated for several years with the Alumni Research Foundation at the University of Wisconsin. This Foundation maintains fellowships in the graduate school of science at the University, and patents taken out by these fellows have been a substantial source of income for the University. A similar system of fellowships is proposed in the Development Plan for the graduate school at Armour Institute.

Stuyvesant Peabody is President of the Peabody Coal Company and the Consumers Coal Company, both of Chicago, and he is a director of many other coal and fuel companies in the middle west.

Mr. Peabody attended Yale University from 1907 to 1911. He served as a 1st lieutenant in the Sanitary Corps, and later as a Captain in the Chemical Warfare Service during the World War. He is now a Major in the Officers Reserve Corps.

C. Paul Parker, a patent attorney, came to Chicago from Nebraska in 1905. He studied at Lewis Institute for three years, after which he studied law at the Chicago Kent College of Law, receiving his LL.B. in 1913. He was admitted to the bar in Illinois in 1913, and has been practicing patent law in Chicago since then. He is a member of the firm of Chindahl, Parker, and Carlson. Mr. Parker's work has given him an intimate contact with the textile industry and with the electrical industries. The staff of his firm includes experts who are graduates in Mechanical, Electrical, and Chemical engineering.

Mr. Parker has been admitted to practice before the Supreme Court of the United States, and various subordinate Federal Courts, and is active in the trial of patent cases and in practice in the U. S. Patent Office. He is a member of the American Bar Association, the American Patent Law Association, and the Chicago Patent Law Association.

P. Emil Seidelmann, F.P.E., '31, is at present employed by the Ohio Inspection Bureau at Cincinnati, Ohio. He may be reached at the Harrison Club, 2368 Victory Parkway, Cincinnati, Ohio.

V. A. Sturm, Ch. E., '30 took the big step recently. He and his bride are now in Schenectady, N. Y. where Vern is employed with the General Electri Company.

News has been received that Dan E. Rutishauser, M. E., '23, and basketball star of the early '20's is now the proud dad of the first addition to his household. [illegible]utishouser is spending his time in St. L[illegible] working for the Hussman Refriger[illegible] Co. as development engineer and pr[illegible]duction manager.

Promotional Fund Increases at Rapid Pace

The alumni of Armour have well given evidence of their loyalty to their alma mater in their response to the promotional fund. The drive was begun at a dinner at the Medinah Athletic Club, March 31. The alumni were told of the voluntary student response to announcements of the expansion and development plan, and received this news enthusiastically. Two speeches, one by James D. Cunningham, Chairman of the Development Committee, and the other by Perry Addleman, Secretary of the Committee, explained the history of the plan's formation and its essentials.

The total of the promotional fund has reached $47,000 to date, the Special Gifts total having amounted to approximately $10,000.

The regular team solicitation of Chicago alumni ended April 25, and the remainder of the fund will be raised by general solicitation, the workers not being restricted to prospects within their own class and division groups. Out-of town alumni are being organized in forty-three cities, and it is believed certain that the $60,000 quota will be surpassed very soon.

Leo L. Reihmier, M. E., '22, has returned to Chicago, taking a position here with the Lloyd Thomas Appraisal Co. Reihmier was formerly employed by the American Appraisal Company of Milwaukee Wisconsin.

Earl W. McMullen, Ch. E., '09, recently left the Research Laboratories of the Celotex Company in Chicago and accepted a position as superintendent of the lacquer division of the Alt and Noburg Company in Cincinnati.

Hiram W. Montgomery, F. P. E., '30, who is employed with the Illinois Inspection Bureau at East St. Louis now has four members in the Montgomery family. The additions to the family were in the form of twins and we venture to say that "Monte" must feel proud in the role of father.

Maxwell F. May, M. E., '22, and Ray C. Malvin, M. E., '21 have combined into a firm which is listed under the head of Malvin and May, Inc., consulting engineers and factory dealers.

Leo A. Ohlinger, C. E., '27, is now connected with a large concern of consulting engineers.

H. J. Hansen, C.E., '03, is Assistant Engineer of the Bridge and Building Department, C. M. St. P. and P. R. R., at the Union Station, Chicago, Ill.

Personals

The Cincinnati department of the Ohio Inspection Bureau has three Armour F.P.E.'s of the class of 1929 on its staff of inspectors. These are Charles D. Lamb, Elmer J. Sherman and Elwin K. Rohr.

Mr. E. W. Brockman, F. P. E., '29, officiates in basketball games in the Northern Indiana High School League.

Word has reached the Institute of the marriage of Eugene A. Pensinger, '24, to Agnes Dullum on January 27, 1932. They are now residing at 4904 Jackson Boulevard.

Milton F. Daniels, F. P. E., '11, is now superintendent of the Improved Risk Department of the Fireman's Fund Insurance Co. He was formerly special agent of that company.

Soloman Krivo, E. E., '25, is now teaching electricity in a south side high school.

John Stastny, E. E., '24, is connected with the Shell Petroleum Co., where he is on the engineering staff. He resides in Hammond, Indiana.

C. H. Teesdale, Ch. E., '08, recently visited the Institute. He is now a manufacturer of pumps in Grand Rapids, Mich., where he also has charge of the Alumni Promotional Campaign for that area. While at school, Mr. Teesdale helped design and build the diffusion battery now in the 4th floor hallway.

An interview was recently observed between R. F. Steward, Ch. E., '07, and Professor McCormick. Inasmuch as the former is a patent attorney of New York City and Washington, D. C., the interview probably concerned some patents in which they have a common interest.

Among the alumni present at the Alumni Promotional Campaign Dinner at the Medinah Athletic Club, Thursday evening, March 31, were Woldenberg, '06, Harper, '05, H. W. Martin, '10, Whittington, '14, Hirsch, '14, Herbst, '22, G. A. Morgan, '24, and Sites, '23.

Mr. James R. Sloan, '97 represented Armour Institute of Technology at the inaugural exercises of Dr. Ralph Cooper Hutchinson as President of Washington and Jefferson College on April 2, 1932.

Mr. Sloan, who has the degree of B. S. and E. E. from Armour, is chief electrician of the Pennsylvania Rail road.

Oscar Erickson, C. E., '11, is developing a plantation estate in Camden, S. Carolina.

William Drigot, E. E., '31, visited the Institute several ages ago on his way to Schenectady, N. Y. where he will take up the student course offered by the General Electric Company.

Alumni Association Asks the Aid of Members

There are a large number of Armour alumni whose present location is not known. The assistance of all graduates and former students is asked in order that this condition may be remedied. Scan the following list and if you see the name of a friend please notify the Alumni Association of his address and business. The roman numerals refer to the department in which the individual received his degree. Thus, I is C. E., II is M. E., III is E. E., IV is Ch. E., V is Arch., VI is F. P. E., and VII is Industrial Arts, this last department having been discontinued in 1923.

Ellis E. Andrews IV '08
Walter B. Arp III '13
Howard J. Ash III '05
Guy L. Andre II '18
John C. Brackett III '05
Leroy H. Badger I '07
Chas. W. Barger VI '26
Jose A. Beeh II '28
Wm. E. Briggs III '29
Manley F. Baird III '02
P. L. Bradford III '11
Allan W. Barr V '14
Louis J. Blume V '26
Sheldon Bloomberg III '20
Kent W. Bartlett IV X01
Wm. E. Bliss II X31
Andrew S. Clark V '23
Gilbert S. Cooley II '14
Frank S. Cowles V '19
August C. Cramer I '13
A. H. Crocker Jr II '10
Ralph M. Crow V '13
Harry L. Case III '14
Paul R. Chapman III '97
Frank C. Collins III '08
James W. Cohn III '24
George P. Cullen V X11
Wm. E. Dady V '19
Allen L. DeVol "A"
Robt. C. Doering VI '11
Fred C. Downs IV '23
Edward J. Durham II '18
Toyozo Enoshita III '12
Norman L. Edson II '06
Raymond A. Erickson III '18
Ralph W. Ermeling V '13
Nels H. Erlandson III '22
Robt. T. Evans II '09
Harry T. Fultz VII '22
Connell J. Furay V '13
Henry G. Florian X30
John R. Frederick III '25
S. C. Finkelstein V '16
Warren F. Fryburg III '13
Ralph Garbett IV '29
T. E. Gentry II '10
Elias Georgevich II '22
Frank R. Goldsmith II '05
Jerome Goldstein II '23
Ted (Israel) Greenfield IV '24
Francis H. Griffiths II '11
Clarence A. Grabendike III '21
Wm. Goodman II '24
Gordon Goodwin II '26
Robert Hall II X11
Edward W. Haines II '17
A. G. Hall II '09
Harry S. Harris (Katz) III '16
Edw. T. Harwood III '02
Leonard M. Holmes I '22
Thos. H. Hart III '24
Alfred B. Heyes III '27
Yoshisakee Hirose V '15
Norman Huffaker II '18
John G. Johnson IV '25
Sydney W. Kendall IV '17

Joyous Reunion Planned For Class of 1907

The Tech Class of '07 plans a three-day period of gayety and reminiscence to celebrate the twenty-fifth anniversary of their graduation. All members of this class not already in touch with the committee should get into contact with them at suite 313, Peoples Gas Bldg., Chicago.

The program will contain an afternoon at the Institute, with a dinner and visits with the faculty. A radio broadcast, an auto trip to show out-of-town men the Century of Progress buildings, and as a climax, an entire day on the country estate of one of the men of '07, completes the schedule.

In keeping with the spirit of the times, expense has been reduced to the minimum, with an utter disregard for banquets and theatre parties.

John Kramer III '23
Edward S. Kujawski V '14
Morris J. Knapp III '04
Albert Kaempfer III '03
Edward F. Kappes III '98
George Kuta III X31
George H. Lee III '27
George D. Lewis I '12
Smith H. Latta II '08
Richard A. Leavell II '10
Clifford E. Larkin III '25
John E. Lanning III '03
Meredith F. Lawrence II '12
Jos. David Loofbourrow II '08
Harold P. Langstaff III '12
Arthur J. Mueller IV X30
R. M. Montgomery I X26
Grover O. Melby I '26
Frank J. Mack I '12
Donald J. McFaul II '25
Wm. J. McCormack V '22
E. Wallace McDiarmid VI '16
Harry A. Mammes III '15
Robt. C. Martin III '00
Fernando K. Meyer IV '26
Thaddeus K. Mieczkowski III '15
Jos. V. Miller II '16
Sidney H. Minchin V '15
Chas. W. Mintz VI '19
Ralph D. Morrison II '06
Archibald W. Morrow V '14
Harry G. Mouat II '16
Wm. K. Munn IV '13
David K. Muramoto III '21
Frank E. Myers III '11
Paul C. Nieland II X23
Carl A. Nelson II '24
Max O. Oboler III '23
Wm. H. O'Brien I '23
Conrad L. Ott II '16
Thos. W. O'Dea VII '16
Edmund A. Pratt I '07
Arthur A. Perrine III '09
F. L. Pond III X16
Wladislaw S. Pawlowski II '21
Wm. W. Pearce III '21
Harold C. Peterson II '20
Victor J. Peterson II '27
Edward W. Prentiss I '25
Chas. P. Pelta IV X23
Ernest L. Quien IV '03
W. F. Roberts I '14
Austin J. Rice III X19
Bela de Rimanoczy III '99
Earle S. Roos III '03
George Rose Jr. II '25
Garland F. Reichle X30
Max Salamson III '97
Max L. Schwartz III '23
Edwin Schwarz III '25
Sydney Shaffer III '15

Open House to Be Gala Event

A large attendance is expected at the Institute Open House, to be held Friday evening, May 27.

The usual exceptionally interesting experiments will be on display from 7:30 to 10:00 p. m. All laboratories and shops are to be open for inspection. Members of the faculty and student body will be on hand to answer all inquiries.

In addition to the electrical, chemical and mechanical exhibits, a new feature is to be added this year; the Philatelic Society is planning to display their large and interesting stamp collection in the library.

Students have been urged to bring their parents to see the laboratories and shops in action, and all interested high school students and graduates have been very cordially invited through the medium of invitations mailed to all secondary schools in the Chicago area.

Open House affords the alumni an excellent opportunity to revisit the scenes of their former scholastic endeavors and to see the Institute in full operation and pageant-like display. New features will be on display, also exhibits to illustrate fundamentals of science and technology. Each department will have its own individual display to intrigue all visitors.

Open House of 1931 received over two thousand visitors and it is hoped to surpass even this great number in the 1932 display. The Dean's office is to be open that evening to answer all inquiries as to the Institute's administration and courses of study, many of which are received from interested high school students desirous of any obtainable information as to engineering education and qualifications for its successful pursuit.

A. G. Stark V '15
John B. Swift III '01
S. Silverberg IV '22
James Smely III '20
Arnold H. Smith IV '17
Louis H. Sommers V '23
Harry C. Stanley V '13
Gustav Stanton Jr. I '07
LeVere H. Stem IV '05
Paul Leo Stern IV '20
Howard G. Stillson III '03
Elmer J. Swnason VII '24
Frank A. Swanson III '14
Morris Thompson I '07
John K. Thompson IV '05
Robert C. Trow V '23
John Wm. Turner V '17
Frederick W. Twitchell III '99
Alva W. Tyler III '05
George F. Uebele I '27
Victorio Verano I '27
Jerry Williams I '25
Fred H. Wagner V '15
James McC. Watt II '04
Joseph Weinberg III '27
Warren E. Weinsheimer III '98
Fred B. Whitney I '05
Geo. C. Wilsnack IV '08
Wm. G. Wilson VII '25
Bruno E. Wolgemuth II '21
Yuk Man Wong II '20
Malvin E. Wright III '05
Henry T. Yoshida II '12
Arnold Zimmerman II '17

The Modern Trend in Car Design

(Continued from page 103)

It must be remembered that ventilation does not occur every time a hole is made in the body. In the future it is probable that we will not have to open a windshield in order to obtain ventilation, but this part of the design must be left to the expert in aerodynamics.

We are familiar with and have learned to like the beauty and symmetry of streamlined bodies like those of the aeroplane and dirigible, but few people, even engineers, realize that a correctly shaped body will travel through the air at 30 to 60 m.p.h. with only one-third of the air resistance of an incorrectly shaped body of the same volume. For instance, a plain cylinder of length about 1½ times its diameter has four times as much air resistance at any speed as the same cylinder with correctly streamlined ends added.

The foregoing applies also to an automobile. Since air resistance is the greatest part of the total resistance of an automobile at touring speeds, a properly shaped automobile can be made to travel from 2 to 2½ times as far per gallon of fuel as the conventional car, the proportion depending upon the speed. In other words, the streamlined car would give 20 to 50 miles per gallon of gas, instead of the present 10 to 25 miles.

With these startling and well based facts before us, we must next determine the proper streamlined effect.

The British Admiralty has conducted exhaustive tests upon airship models based upon the forms of the fastest and most efficient fish. The form, virtually that of a Greenland shark or blue whale, was adopted as a model for the streamlined enclosure. Then it was discovered that the streamlined body not only was adapted to fast and economical travel through the air, but it had unexpected advantages in connection with other features and units of the car as follows:

(1) A body of this form is adaptable to unit construction, simulating the trussed structure and strength of a bridge eliminating the need for the conventional chassis frame.
(2) With suitable streamlining and the bottom of the body modified to be more nearly parallel to the road surface, there was ample room behind the rear seat for the engine, eliminating its usual noise, vibration, and heat odors
(3) In front of the front seat is ample room for the steering gear and storage space comparable with that of the deck of the ordinary roadster.
(4) The engine, transmission, rear axle and rear springs can be incorporated in one unit which is assembled directly to the body frame on the final assembly line.
(5) The front springs, front axle, and steering mechanism can be incorporated in another unit, which also is assembled to the body on the final assembly line.
(6) The seats can be placed between the axles and may be as low as desired because of the absence of the propeller shaft.
(7) The streamlining at the front can be modified to obtain clear vision without materially sacrificing aerodynamic afficiency; it is the maintenance of approximately correct streamline form at the rear that is of great importance.
(8) Fenders, running boards and outside headlamps can be streamlined, or their wind resistance can be eliminated by incorporating them in the main structure of the body.
(9) The general outline including the main streamlined form, windows, moldings and color scheme, are adaptable to unlimited variation.

The obvious criticism to the car as pictured above would be the radical difference in style, but in time people would undoubtedly think as highly of the streamlined, or tear-drop, car as we now think of the present day car over those of the early 20th century.

In one wind test a touring car was used. The weight of the car, including three passengers, was 2900 lbs. The car was driven by a four cylinder 4x6 in. F-head engine which developed 75 h.p., and the speed attainable was 71 m.p.h. At this speed it was found that 48 per cent of the available power was absorbed by wind resistance. More elaborate tests were conducted with sedan models.

The modern sedan, carrying a conventional body, probably would require 80 percent of the total effective power of the engine to overcome wind resistance at speeds of 65 to 70 m.p.h. Thirty per cent of this power could be saved by better body design, and the performance and economy would be much improved.

A railroad car that has been built for the German National Railway at Hanover, Germany, and tested on a track approximately 5 miles in length, attained a speed of more than 100 m.p.h. with forty passangers. This car is of the coach type and is fully streamlined, having a blunt nose containing the driver's compartment. It weighs 20 tons, is 85 feet long, and is driven from the rear end by an airplane engine and a large four blade propeller. A speed of 124 m.p.h. has been attained for short stretches, and calculations indicate that it is capable of doing 185 m.p.h., for which tremendous speed only 400 h.p. is required.

Two remarkable facts stand out:

(1) The conventional sedan has a resistance or drag due to the wind somewhat over 2½ times that of a car streamlined properly.

Estimated Total Road Resistances of Conventional and Tear-Drop Sedans

Speed M.P.H., (v)	Total Road Resistance, lbs., (F)		Ratio of Resistances
	Conventional	Tear-Drop	
90	425	182	2.3:1
80	342	150	2.3:1
70	270	127	2.1:1
60	208	103	2.0:1
50	155	81	1.9:1
40	112	65	1.7:1

(2) The superiority of the tear-drop design as to decreased drag remains in approximately the same proportion, regardless of speed. In other words, the wind resistance of the conventional design is approximately 2½ times that of the tear-drop design at any speed.

The total resistance of an automobile at any speed is expressed by the equation:

$$F = r + R$$

Here F is the total resisting force and R and r respectively are the wind resistance and the friction resistance of the car, all in pounds. The frictional resistance, r, increases somewhat with the speed, but it is nearly enough constant so that an average value can be used without objectionable error. The wind resistance, R, is the wind-tunnel-test figure for a full-size car. It can be approximated for a conventional sedan by the equation:

$$R = 0.002\ AV^2$$

In this, A is the frontal area of the car in square feet, and V is the velocity in miles per hour, and 0.002 is an approximate constant that has been well established by wind tunnel tests. The frictional resistance of a car this size may be assumed to be 35 lbs.

Having determined experimentally the frictional resistance and the ratio between the wind resistance of the two models, we can determine the total road resistance for both models at various speeds by means of the above two equations. The values shown in the table were computed by means of these equations. It is interesting to note that the total road resistance of the conventional sedan varies from 1.7 to 2.3 times that of the tear-drop design at speeds from 40 to 90 m.p.h. As the horsepower and fuel required at any speed vary roughly as the total resistance to be overcome, it follows that the tear-drop car will run approximately twice as far on one gallon of gasoline as will the conventional sedan.

A body like that of an airship or aeroplane, traveling freely through the air without directing or controlling contact such as is afforded by wheels on a road-bed, depends to a considerable degree for its stability and smooth directional travel upon the relative locations of its center of gravity and its center of resultant wind pressure. If it is so designed and proportioned that its center of gravity is ahead of its center of wind pressure, a righting couple results whenever it tends to deviate from its direction of motion, tending automatically to return the body to its original alignment. This is of considerable importance in aeroplane and dirigible design; it is not believed to be critical in a tear-drop automobile for the following reasons:

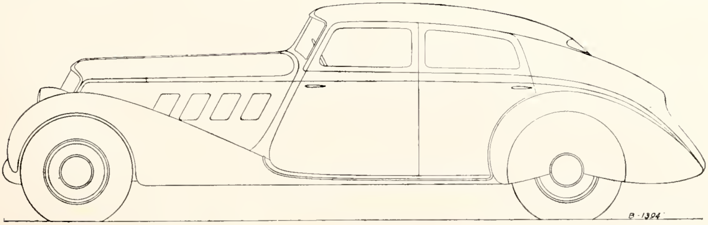
(1) Stability and smooth directional travel of an automobile can be maintained with no considerable righting couple because of the directing and controlling contact of the loaded front wheels on the road-bed.

(2) In the tear-drop car, the front end may be so designed as to give, at 60 m.p.h., a downward component of the wind pressure which will load the front wheels sufficiently to assure directional control at this speed. This downward pressure is added to the front-axle weight of the car and increases with increased speed. It also decreases with decreased speed, enabling exceptionally easy steering for low-speed operation. The location of the center of gravity of the car and its load is thus not of critical importance in the matter of steering and directional control in the tear-drop car as it is in conventional sedans and in aeroplane or dirigible bodies.

(3) The front axle can be well loaded and the center of gravity should be far enough forward, with the forward seats located well up in the body; ample storage space is provided in the extreme front end in which will be located the extra wheel and tire, tools and baggage; the rear seats, the battery and a part or all of the engine unit is located ahead of the rear axle. This will avoid any noticeably disturbing couple at high speed.

Present-day automobiles were designed, as to both appearance and general arrangement, 20 to 30 years ago, when speed and operating economy were relatively of little or no importance. Naturally, and rightly, aerodynamic conditions of adaptability to high-speed travel through the air were not then considered. Today high speed, economy and maximum comfort are demanded. The automotive industry and the engineer can supply this demand with the rear-engined, streamlined, tear-drop car having a low center of gravity.

Proof that accurate information concerning the advantages of streamlining is having its effect upon automobile manufacturrs may be evidenced by the changed design present on current models. Thus it is exceedingly probable that in the course of a few years the public will gaze back upon the present models with the same amusement with which we now view cars of twenty years ago.



Courtesy—Automotive Industries

This model embodies the tear-drop principle, but retains the engine in the front. It is a compromise with public opinion.

Humor?

He: "Gosh, your dumb."
She: "Is that so?"
(Tech News)

Lecturer: "And my dear friends, I ask you, what is a home without a mother?"
Clanton: "An incubator."

Her eyes were black as jet,
This charming girl I knew;
I kissed her, and her husband came,
Now mine are jet black, too

Dizzy Izzy rocked the boat;
Dizzy Izzy couldn't float.
Exit Dizzy.
Funeral Note.

Entertaining

Her: "Oh, don't make me yawn."
Him: "My name ain't Yohn, it's Yim."

Red Agitator: "Down with capitalism!"
Wee Willy: "And punctuation, too."

"There's a good combination shot," cried the co-ed as she removed the tattered lingerie from her laundry bundle.
(White Mule)

The Three Blind Mice Are Educated

Three rodents with defective vision.
Note the manner in which they flee.
They all pursue the spouse of the agriculturist,
Who severed their extremities with a kitchen utensil.
In the entire span of your existence have you ever seen such an unusual phenomenon as
Three rodents with defective vision?

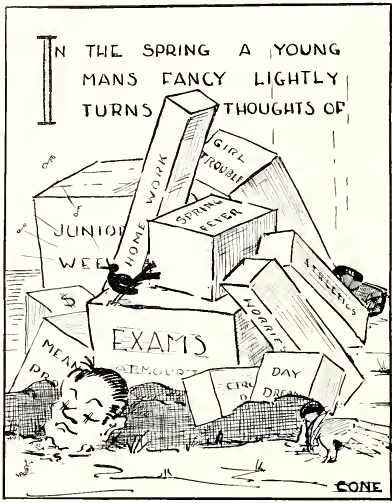
Definition of the word "raise" in the latest edition of the new dictionary:—"An obsolete term meaning increase in salary."

"The young bride certainly does worship her husband, doesn't she?"
"Yes; she places burnt offerings before him three times a day."

A Lofty Soul

"Are you looking at my knee?"
"No, dear; I'm above that."

Abel: "Are we alone?"
Mabel: "I hope God is with us."



Ain't It So?

Mary had a little cow
And, oh, how it did stutter
In place of every quart of milk
It gave a pound of butter.

Extract from 'Tech News'—
"Advertizment—
Wanted—Jokes slightly off color.
—The Armour Engineer" (or was it the Armour engineers?)
The subtle humor is incomprehensible, but to avoid further embarrassment please do not read any farther.

Student: "I've swallowed my watch. What can you do for me?"
Doc: "I'll have to give you something to pass the time away."
(Pennsylvania Triangle.)

Monday Night Blues

"Mine is no idle tale," said the freshman as he leaned over for another whack. (Black and Blue Jay)

First Sparrow: "Are you going south this winter?"
Second Sparrow: "Am I? Say, I wouldn't miss the Agua Caliente Derby for a peck of grass seed."
(Voo Doo)

He: "They tell me you neck?"
She: "That's my business."
He: "Well, how'd you like to do a little business?"

Romance

" 'An we'll have a bungalow just lousy wit' honeysuckles."

Man, very hoarse with a cold, not able to talk above a whisper, knocks at doctor's home at night and the doctor's wife comes to the door: "Is the doctor at home?"
Wife, also in a whisper: "No, come in."

Rushee (to himself, after a heavy palaver): "I wonder if I ought to let him kiss me?"

Spring is largely overrated
When one is already mated.

It wasn't liquor that killed old Ben;
Nor women that stopped his breath—
'Twas an Austin somebody drove up his leg
And tickled old Ben to death.

"How was your date?"
"Fair to meddlin'."

Postscript

If this page has shocked any of the patient readers please report to the 'Tech News';—the 'Steam Shovel' column has been begging for 'contribs'.

Essentials of Weather Prognostication

(*Continued from page* 104)

vation is still of importance and practical use. It is of particular importance to anyone planning a trip where weather forecasts are not available. A knowledge of the weather and its vagaries may often cause him to change his plans to advantage and may even be a means of insuring his safety. Aside from its practical uses, an intimate knowledge of the sky, winds, clouds, and heavenly bodies, such as necessarily comes of a study of prognosticating the weather, offers a very pleasureable pastime.

Unfortunately, there are no infallible rules to follow in weather forecasting, for the weather is very fickle. However, certain signs and factors point to definite weather changes to follow, and while a change in temperature or atmospheric conditions might spoil an apparently logical prediction, in the majority of cases the sequence of events comes out about as scheduled.

It remains then for anyone who would be weather-minded to familiarize himself with these preceding conditions. He must, however, sort out from the maze of proverbs and signs that have been handed down through many centuries those that are based on sound principles, and throw out those that are without foundation.

The color of the sky and the appearance of the sun, moon and stars are good weather indicators. The reason for their value as indicators is because they show very clearly the state of the atmosphere, which is the best reflector of what the weather is about to be. The most familiar of these signs concern sunrise and sunset. A clear sunset in a red evening sky denotes a relatively dry atmosphere, and for this reason is a good omen of fair weather on the morrow. If there is a green or yellow tint, the chances of fair weather are even greater because this indicates a very dry atmosphere. A sunset in a hazy sky, however, manifests a humid atmosphere, moisture in the air being condensed into clouds by the low temperatures aloft. The actions of Nature during the night are such that the reverse of these signs is true. A grey sunrise with an early morning fog rising from the lowlands, gives promise of a good day, while a red sunrise is a bad omen.

Many conditions of the weather have been attributed to phases of the moon, but we are informed by scientists that except for the very slight effect of tides on the atmosphere, the moon has no control on the weather. However, it does, by its appearance, denote the condition of the air. Thus, a brilliant, white moon is significant of a clear atmosphere, while a misty, pale moon is a fair sign of stormy weahter to follow. The stars are also a good indicator by their appearance on a moonless night. Coronas and halos are generally signs of a storm.

Dew forms at night only when atmospheric conditions are such that a rain can hardly occur, and, on still nights, if dew fails to appear it is a fair indicator of rain to follow.

From the manner in which rain approaches it is often possible to judge the duration of the storm. Rain clouds that form rapidly, as in a local thunder-shower, soon dissipate and pass over. A storm that is a long time in forming is usually a lengthy disturbance.

Night rains very seldom last through the day and a clear, sunny afternoon can be depended upon.

Clouds are one of the best weather indicators of Nature. The familiar large fluffy clouds of the

cumulus variety seen on bright, sunshiny days are excellent fair-weather indicators. They usually make their appearance late in the morning and disappear in the evening when the air begins to cool. In humid weather, however, they change from harmless cumulus clouds to the nimbus clouds, known as the "Thunder-head", and usually presage rain. Cirrus clouds are thin wispy clouds so high up as to be made up of ice crystals even on the hottest day. When they form into curling wisps a storm is in the offing.

Winds are also good weather indicators; like cloud travel, a west wind is usually a fair one, while a northwest wind is a sign of good although cool weather. South and east winds often precede muggy weather, while a northeast wind will bring disagreeable rains in summer and blizzards in winter. A wind that changes direction counter-clockwise manner, is a promise of fair come, while a veering wind, one that changes direction in a clockwise manner, is a promise of fair conditions. A falling barometer and a backing wind are two signs that should never be ignored.

A barometer is probably the best indicator of weather change that is available, and the amateur forecaster would do well to equip himself with a portable aneroid barometer. Barometer indications and the probable results are summarized in the included table prepared by the United States Weather Bureau.

Now that we have a knowledge of weather prognostication by means of local observations, let us turn to a study of the tools used by the official forecaster. This much maligned and little appreciated individual does not guess at the weather as some of us like to believe. We remember only those times when he is wrong and forget that he is correct eighty to ninety percent of the time. The proximity of Lake Michigan and its important effect on the weather makes forecasting in the Chicago area very difficult. If the city were situated in a vast prairie the weather man would be correct in his predictions ninety-eight percent of the time.

The United States Weather Bureau is a large organization with over two hundred observation stations in all parts of the country. Observers at these numerous stations, all acting simultaneously, are able to accomplish as satisfactory a survey as would be obtained by one person from a single point if such a thing were possible.

Every twelve hours, precisely at 7:45 P. M. and 7:45 A. M., seventy-fifth meridian time (E.S.T.), the observers in all parts of the country begin work of observing and recording weather conditions, each in his respective territory. The sky is observed and the clouds classified; barometers are read and corrections applied to reduce to sea level, that readings may be compared with those of other stations; the direction and velocity of the wind is noted; the precipitation, if any, is measured; the current temperatures and the extremes since the last reading are recorded; moisture content of the air and other phenomena such as thunderstorms, fog, halos, are noted.

Barometer Table

Indications	Wind	Barometer
Fair and little temp. change	SW-NW	High & Steady
Fair followed by warmer and rain within two days	SW-NW	High & rising fast
Rain in 24 ot 36 hours	SW-NW	High & falling slowly
Increasnig wind with rain in 12 to 24 hours.	S-SE	High and falling rapidly
Summer: fair. Winter precipitation in 24 hours.	E-NE	High and falling slowly
Precipitation in 12 to 24 hours.	E-NE	High and falling rapidly
Rain will continue one or two days	SE-NE	Low & falling slowly
Rain and high windfi clearing in 24 hours.	SE-NE	Low & falling rapidly
Clearing soon and fair severla days.	S-SW	Low nad rising slowly
Severe storm soon	S-SE	Low and falling rapidly
Northeast gales with heavy rain or snow.	E NE	Low and falling rapidly

Each observer then condenses the information he has secured into a cipher message of a few words, which is telegraphed to Washington and other large cities where the message is expanded and placed on a chart or map.

The locations of the observing stations are indicated on the map by small circles. Where cloudiness prevails the whole circle is darkened; for partly cloudy one half of the circle; and the circle is left open to indicate clear conditions. Precipitation is shown by R and S, denoting either rain or snow, as the case may be. Arrows are made to fly with the wind. The temperature, barometer reading, wind velocity, and depth of precipitation is placed near the station in small numbers. When the precipitation has been general over a relatively large area, the area is shaded. Lines are drawn through points of equal barometric pressure and are known as isobars. Dotted lines on the maps are isotherms, lines drawn through points of equal temperature.

In less than two hours after the observations have been taken, the various forecasters are, figuratively speaking, standing on pinnacles overlooking the entire country and are prepared to give out information regarding the weather conditions at any place. This is not to be construed as a forecast, but as a statement of the actual conditions that prevail at the time of the observations. However, it is upon these maps that the forecaster bases his prophecies for the next twenty-four hours.

The centers of low barometric pressure are indicated by the word "low" and centers of high barometric pressure by the word "high." To the casual observer this has little significance but to anyone who has a working knowledge of meteorology it offers an excellent means of foretelling future weather conditions. Let us study for a moment the characteristics of areas of low and high pressure.

An area of low is caused by convection currents, which when they move upward, cause a decrease in pressure. If the air in these convection currents has gained any moisture, clouds will form when a sufficient height has been reached to condense the vapor. These clouds are the familiar cumulus type seen so often in fair weather. If the moisture content of the air is high the cumulus clouds are converted into nimbus, invariably bringing rain. It is for this reason that a low is known generally as a storm area. An area of extreme low pressure is called a cyclone. Since cyclonic disturbances are rare in this part of the country we will not consider them.

Low pressure areas move in a generally eastward direction, there being two well-defined storm tracks, the first, from the Canadian Northwest across the Lake region and out the St. Lawrence valley, and the other, over the middle Rocky Mountain re-

gion to the Gulf States. After crossing the Gulf States the lows almost invariably re-curve up the Ohio Valley and leave the country by way of the St. Lawrence valley, or travel up the Atlantic coast. Weather changes over the Canadian Northwest will appear from three to four days later over the Eastern States. Thus, the weather forecaster, observing on his synoptic chart a rain accompanying a low pressure area to the Northwest, will predict rain; the time of arrival depending on the distance and the speed of the storm area at the time of the forecast. The prophecy is never infallible, for local conditions may divert the storm or dissipate it entirely. This is especially true of the city of Chicago because of the presence of Lake Michigan. The value of the forecast is in inverse ratio to the distance of the storm at the time this prophecy is made.

An area of high pressure is known as anti-cyclone because the conditions are the reverse of those existing in a low. The sky is clear with a more or less hazy horizon, while the air is invigorating and dry, with low temperature if the season is spring or autumn. Highs and lows follow each other across the country in a rather regular sequence.

It is not to be supposed that the weather man makes his prognostications from a study of the weather map alone. He must make the same local observations that we would if we attempted to do our own forecasting. It is only by means of these local signs that he is able to forecast spring thunder-showers. By bearing in mind the movements of highs and lows the novice can very readily forecast the weather with the aid of synoptic charts and local observations. Of course, the question of topography and the location of land and water areas with regard to the place for which the prediction is made are highly important factors, and the individual of limited experience should not expect to make altogether satisfactory forecasts without considering these important influences.

There are many changes in high and low-pressure areas as they progress across the country caused by local conditions. Precipitation changes in amount and form, and temperature varies with every locality. Thus, it is not to be expected that the precipitation will be as heavy as a low passes over the arid Western states, where bodies of water are scarce, as it will be as it passes over the Great Lakes Region.

In a constant study of the weather maps, as is required of the forecasters in Washington, peculiar relations are observed between certain characteristics which are valuable aids in the work of forecasting. A large collection of such observations has been amassed and tabulated by E. H. Bowie and published in a supplement of the Monthly Weather Review, and in "Forecasting in the United States."

Weather predicting is not difficult; anyone who will keep in mind the general actions of high and low-pressure areas and topographical features will experience little trouble in accurately forecasting the weather. At least it is a pleasureable pastime, and one that can be of much practical use to anyone.

The Solvay Process of Alkali Manufacture

(Continued from page 105)

coke. The kilns are closed at the top, the gases being drawn out by powerful air-pumps, washes being interposed between the kilns and the pumps for the purpose of purfiying and cooling the gases. The heat evolved by the compression in the air-pumps (about 4 atmospheres) is again removed by cooling, and the gas is led into the bottom of the "Solvay tower." This is a tall iron erection, built up from superposed cylinders, which are separated from each other by perforated horizontal diaphragms. These diaphragms are constructed in such a manner that the gases are repeatedly subdivided into many small streams and are thus thoroughly brought into contact with the ammoniacal salt solution with which the tower is about two-thirds filled. In this tower, the reaction mentioned above takes place, and owing to the concentration of the liquid, the sodium acid carbonate which forms is to a great extent precipitated in the form of small crystals. This reaction takes place with considerable evolution of heat, which is removed by internal and external cooling with water. The temperature must not be allowed to rise beyond a certain point, because the reaction by which sodium acid carbonate is formed is reversible, and at a temperature of about 70° C. is practically going the wrong way, producing the ammonium acid carbonate and sodium chloride. On the other hand, the cooling must not be carried too far, for in this case the crystals of sodium acid carbonate become so fine that they form a muddy mass with the mother liquor that is very difficult to filter. The most advantageous temperature for the reaction seems to be about 30° C.

Either at certain intervals or continuously, a portion of the contents of the tower is withdrawn, and fresh ammoniacal salt solution is introduced higher up in the tower. The muddy liquor running out the bottom is passed on to the filters. The filters usually are a combination of from two to five filters operating on the vacuum principle. Here a separation is effected between the sodium acid carbonate crystals and the mother liquor. The former are washed with water until nearly all the chlorides are removed, and then carried into the drying apparatus. This must be constructed in such a manner that the bicarbonate, or acid carbonate, of sodium, which always contains some ammonium salts, is first freed from these by moderate heating; later on, by raising the temperature, it is decomposed into solid sodium carbonate and carbon dioxide. The former is then ground to produce the final product, soda ash, from which different grades and forms are prepared, and also caustic soda. The carbon dioxide is again used in the Solvay tower to treat the salt solution, being mixed with the lime-kiln gases.

Various forms of drying apparatus are used to convert the crude bicarbonate into the soda ash, most of them being of the form of the Thelan pan, described here. This is a long trough, of nearly semi-circular section, the whole bottom being exposed to fire, usually gas. A horizontal shaft runs lengthwise through the trough, and is provided with stirring blades, arranged in such a manner that they constantly scrape the bottom so that the salts cannot burn fast upon it, and at the same time move forward toward one end of the trough, where they are automatically removed by a chain of buckets. The ordinary vacuum pan is used for this process also, as it brings about a saving of fuel through the fact that liquids boil at a lower temperature in the vacuum, and hence the water will be evaporated with less heat being used. The soda ash obtained in this manner is of a high degree of purity, containing only from 1 to 2 per cent impurities, chiefly in the form of sodium chloride.

A very important part of the process has yet to be described, namely, the recovery of the ammonia from the mother liquor from the vacuum filters and from the various washings. Unless this recovery is carried out in the most efficient manner possible, the economic success of the process is impaired. Progress enough has been made in this direction so that the loss of ammonia is rarely more than a fraction of one per cent. The ammonia is for the most part in the mother liquor as ammonium chloride, while a smaller part exists in the various washings as ammonium carbonate. These compounds differ greatly in their behavior toward heat. The ammonium carbonates are driven out from their solutions by prolonged boiling, being thereby decomposed into ammonia, carbonate, and water, according to the equation:

$(NH_4)_2CO_3 = 2NH_3 + CO_2 + H_2O$.

The ammonium chloride is not volatile under these conditions and must be decomposed by ordinary slaked lime, or calcium hydroxide. The equation is:

$NH_4Cl + Ca(OH)_2 = 2NH_3 + CaCl_2 + 2H_2O$.

The solution of calcium chloride was formerly run to waste, but now is one of the most valuable by-products of the industry. The ammonia can now be re-introduced into the process.

The reversible character of the principal reaction was at first a drawback, as it permits some of the sodium chloride to remain with the ammonium chloride, and consequently issue from the ammonia stills with the calcium chloride. It has been found, however, that this sodium chloride is a very pure product, and many companies market this product as common salt. It may also go back into the process as salt solution, used with the original brine.

Early attempts at utilizing the output of calcium chloride were all directed toward obtaining free chloride, which was never a success, less than ever since the discovery of the electrolytic process for the manufacture of chlorine. Chemists soon found many uses for the heretofore waste calcium chloride when the economic success of the enterprise depended on it. It was found to be very valuable in the preparation of anti-freeze compounds, and in solution for the preparation of refrigerating brines. Also, due to its ability to absorb moisture, it is used to lay dust on roads and in storage warehouses, in general, anywhere where dust is harmful. Calcium chloride is an aid in cement manufacture, and in the color industry. Its function is to hasten the setting of the concrete, or to hasten the drying of a paint using water as a solvent, as it absorbs the water in the solution.

The Solvay plant in Solvay, New York, a suburb of Syracuse, is one of the largest companies producing soda by the Solvay process in the world. It was built in 1881, and marked the beginning of the alkali industry in this

country. This firm has developed a line of by-products second to none in the United States. One of the largest productions of all is that of caustic soda, or sodium hydroxide, which probably has the widest range of uses of all the Solvay products.

Caustic soda is invariably made from sodium carbonate by the addition of slaked lime:

$Na_2CO_3 + Ca(OH)_2 = CaCO_3 + 2NaOH$.

The calcium carbonate, being insoluble, is easily separated from the caustic liquor by filtration. As this reaction is reversible, it is necessary to observe the conditions which send it in the right direction. These are diluting with water so as not to exceed 10 per cent sodium carbonate to 90 per cent water; boiling this mixture, and keeping it well agitated. At the best only about 92 per cent of the carbonate can be changed to the hydroxide, 8 per cent remaining unchanged.

After being concentrated to a certain point, and after the separation of nearly all the salts has taken place, the caustic liquor is transferred to cast-iron "finishing-pots", holding from ten to twenty tons. Here it is further boiled until the greater part of the water has been removed, and until, on cooling, the greater part of the salts set to a solid mass. This requires ultimately a good red heat. When it has become completely cleared, the solid caustic soda is transferred to sheet-iron drums, or packed to become the caustic soda of commerce. It is used in large quantities in the manufacture of soap, paper, textiles, and a great many dyes.

The Solvay process, as carried on commercially today, may be taken as a fine example of modern efficient industry. The use of every possible by-product is perhaps the most astounding feature in the study of the process; many and varied uses for every product have been built up. An expert chemist, with a complete knowledge of the chemical properties of an alkali, may not be competent to advise a customer in an intelligent use of it; his chemical knowledge must be supplemented by practical experience in the uses of alkali, and the manufacturing processes into which it enters. Men with this practical experience in the alkali field are in demand today.

The Explosive Limits of Petroleum Vapors

(Continued from page 101)

chamber into the space being sampled, flame arresters consisting of brass rods with very fine holes drilled through them longitudinally are placed on either side of the reaction chamber.

It should be pointed out that the instrument is not adapted to the measurement of mixtures above the lower explosive limit. Pumping such mixtures through the instrument is likely to melt the fine platinum wire catalyst, necessitating its replacement.

The Burrell methane indicator developed at the Pittsburgh experiment station of the Bureau of Mines, while initially designed for detecting methane in mines, has been widely used for the detection of petroleum vapors. When used for this purpose a special scale giving the relative flammability replaces the regular methane scale, and the following will very briefly relate the theory behind the construction of this special petroleum scale.

For the constituents that may be found in petroleum vapor, the lower explosive limits range from

.1 per cent (heptane) to 3.2 per cent (ethane). It requires over three times as much ethane as heptane to produce an explosive mixture. On the other hand, one volume of heptane produces two times the amount of contraction when burned, and if a scale which is based on contractions is constructed with respect to relative explosibility, the two opposing factors largely compensate each other.

A table giving the amount of contraction produced when 100 c. c. of vapor-air mixture at the lower explosive limit is burned would indicate a range from 4.90 c.c. for heptane to 7.75 c.c. for ethane. Thus if a petroleum vapor of unknown composition is tested with the Burrell indicator and gives a contraction of 4.90 per cent, the mixture would just be explosive if the vapors were heptane, but for any of the other vapors, such as petane or butane, the mixture would be nonexplosive.

In view of the above facts, the only scale that would safely indicate an explosive mixture of petroleum vapor of unknown composition in air should obviously be based on the gas or vapor producing an explosive mixture with the least contraction.

That is may be safe for all conditions of use, the petroleum-vapor scale has been devised on the basis of heptane. The safety limit has been set at 0.3 per cent, the maximum value at which a person may be exposed for 30 minutes or longer without serious effects. Thus the mixture does not become explosive until the petroleum vapor is present in quantities over three times the amount that is permissible to allow a person to enter; this wide factor of safety (300 per cent) more than offsets the errors caused by the variations of the composition of the petroleum vapors.

As the reader has already surmised, the Burrell indicator itself, in operation, utilizes the volume contraction of the vapor-air mixture on combustion as a means of ascertaining the degree of explosibility of the unknown atmosphere under analysis. The indicator is essentially a metal U-tube mounted on a base to keep it upright. This is filled with water to a level which corresponds to a point on the scale 0.4 cm. below the zero mark in order to counteract certain variables, such as heat from the glower, solubility of the gases in water, and temperature changes. The platinum coil glower is located at the top of the other arm, and is connected to a battery outside of the device. The sample is drawn into this arm above the water level by means of a hand aspirator. At this stage, the glower is allowed to burn for a 3 minute period, and the final gas volume contraction is read on the scale as a lowering of the water level in the first-mentioned arm of the tube.

If the mixture is within the upper and lower explosive limit when the current is turned on the vapor in the indicator, an explosion will result, often blowing some of the water out of the gauge glass. For a quantitative estimation of petroleum vapor, the percentage present must be below the lower flammable limit; if the vapors are explosive only a qualitative test can be made, which is shown by the mixture exploding in the indicator, and the detector cannot be used for mixtures above the upper explosive limit or for mixtures deficient in oxygen.

In order to obtain samples from inaccessible places, as in large oil tanks and bulk containers, a metal pipe is extended into the place to be sampled and the other end connected to one arm of a 3-way inlet and valve, so arranged that the sample can be aspirated and introduced into the indicator.

Actual tests of the indicator in the hands of inexperienced users have shown it will indicate within 0.1 per cent the amount of petroleum vapor present.

Exact data regarding the lower and upper flammable limits of various vapors, and convenient devices to quickly give the concentrations in unknown samples, are necessary before any advance in protective methods can be accomplished. All these are to be considered as tools with which the safety engineer must create a protective system for his refinery.

Generally speaking, three factors are essential for the development of vapor explosions: (1) combustible vapors in the proper proportions; (2) sufficient oxygen; and (3) adequate sources of ignition. The elimination or proper control of any one of these may be used as a means of preventing explosions.

Ignition sources are so prevalent and varied that it is almost impossible to eliminate explosion hazards by control of this factor. Static charges, such as lightning, or sparks, and open flames are the two most prevalent sources of ignition.

Explosions may be prevented by keeping the oxygen content of the mixtures below a given percentage, depending upon the hydrocarbon vapors present. Oxygen reduction can most easily be obtained by adding inert gases such as nitrogen or carbon dioxide, or both. The extent to which the oxygen content must be reduced also depends upon whether the inert gas is nitrogen or carbon dioxide. A number of the larger refineries have developed elaborate inert gas systems, which are simply pipe lines that introduce the inert gas into the reservoir rather than to allow air to be sucked in, due to temperature changes and various other conditions.

Tables have been prepared which give the percentage of oxygen which must not be exceeded if explosions are to be prevented by the addition of inert gases. From these it is fairly safe to state that if nitrogen is added to any saturated hydrocarbon-air mixture until the oxygen content is below 11.0 per cent, the mixture will not be explosive. If carbon dioxide is added alone, such additions should be continued until the oxygen content of the atmosphere is below 13.0 per cent. If flue gas is used (12.0 per cent carbon dioxide and 88 per cent nitrogen) such additions should be continued until the oxygen content is below 11.5 per cent.

The fact that the oxygen is kept below the values given does not guarantee that explosions are impossible, for if air gains entrance to the mixture, or if by accident the gases leak out in the open, such mixtures, if they contain large excesses of hydrocarbon vapors, will again become explosive when the proper amount of air has mixed with them.

The oil industry as a whole, for the past several years, has realized the necessity of some form of protection for the large reservoirs in use for storing their products and ranging in size from 500,000 barrels to 2,000,000 barrels. It is thought that a proper utilization of the tables and data referred to in this article will do much to decrease the great annual losses in both life and property.

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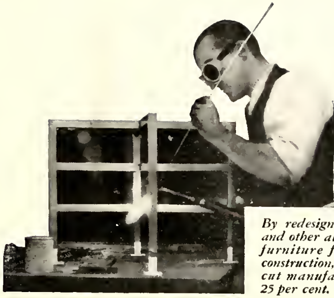

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